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NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

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SPACE SCIENCES For related information see also *Geosciences.*

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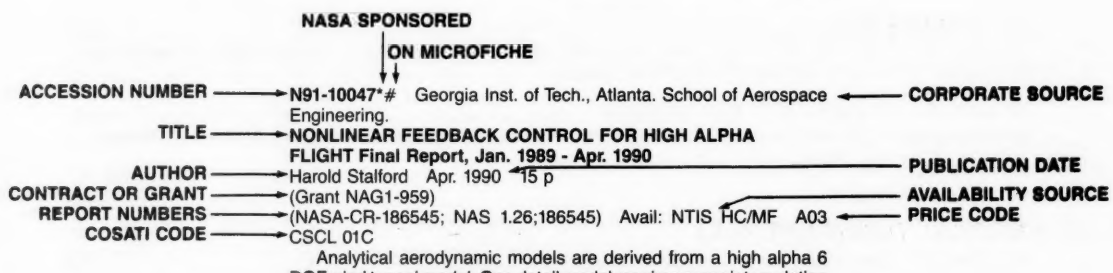

Analytical aerodynamic models are derived from a high alpha 6 DOF wind tunnel model. One detail model requires some interpolation between nonlinear functions of alpha. One analytical model requires no interpolation and as such is a completely continuous model. Flight path optimization is conducted on the basic maneuvers: half-loop, 90 degree pitch-up, and level turn. The optimal control analysis uses the derived analytical model in the equations of motion and is based on both moment and force equations. The maximum principle solution for the half-loop is poststall trajectory performing the half-loop in 13.6 seconds. The agility induced by thrust vectoring capability provided a minimum effect on reducing the maneuver time. By means of thrust vectoring control the 90 degrees pitch-up maneuver can be executed in a small place over a short time interval. The agility capability of thrust vectoring is quite beneficial for pitch-up maneuvers. The level turn results are based currently on only outer layer solutions of singular pertrubation. Poststall solutions provide high turn rates but generate higher losses of energy than that of classical sustained solutions.

Author

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Scientific and Technical Aerospace Reports

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01 AERONAUTICS (GENERAL)

N91-27120*# National Aeronautics and Space Administration. Langley Research Center, Hampton, VA.
VIBRATORY LOADS DATA FROM A WIND-TUNNEL TEST OF STRUCTURALLY TAILORED MODEL HELICOPTER ROTORS
William T. Yeager, Jr., M-Nabil H. Hamouda, Robert F. Idol (Bell Helicopter Co., Fort Worth, TX.), Paul H. Mirick, Jeffrey D. Singleton, and Matthew L. Wilbur Washington Aug. 1991 121 p
(Grant NAG3-55; DA Proj. 1L1-62211-A-47AB)
(NASA-TM-4265; L-16873; NAS 1.15:4265; AVSCOM-TR-91-B-001) Avail: NTIS HC/MF A06 CSCL 01B

An experimental study was conducted in the Langley Transonic Dynamics Tunnel to investigate the use of a Bell Helicopter Textron (BHT) rotor structural tailoring concept, known as rotor nodalization, in conjunction with advanced blade aerodynamics as well as to evaluate rotor blade aerodynamic design methodologies. A 1/5-size, four-bladed bearingless hub, three sets of Mach-scaled model rotor blades were tested in forward flight from transition up to an advance ratio of 0.35. The data presented pertain only to the evaluation of the structural tailoring concept and consist of fixed-system and rotating system vibratory loads. These data will be useful for evaluating the effects of tailoring blade structural properties on fixed-system vibratory loads, as well as validating analyses used in the design of advanced rotor systems. Author

N91-27121*# Institute for Computer Applications in Science and Engineering, Hampton, VA.
THE UNSTEADY LAMINAR BOUNDARY LAYER ON AN AXISYMMETRIC BODY SUBJECT TO SMALL AMPLITUDE FLUCTUATIONS IN THE FREE-STREAM VELOCITY Final Report
Peter W. Duck (Manchester Univ., England) Jun. 1991 44 p Submitted for publication
(Contract NAS1-18605)
(NASA-CR-187579; NAS 1.26:187579; ICASE-91-50) Avail: NTIS HC/MF A03 CSCL 01B

The effect of small amplitude, time-periodic, freestream disturbances on an otherwise steady axisymmetric boundary layer on a circular cylinder is considered. Numerical solutions of the problem are presented, and an asymptotic solution, valid far downstream along the axis of the cylinder is detailed. Particular emphasis is placed on the unsteady eigensolutions that occur far downstream, which turn out to be very different from the analogous planar eigensolutions. These axisymmetric eigensolutions are computed numerically and also are described by asymptotic analyses valid for low and high frequencies of oscillation. Author

N91-27122* National Aeronautics and Space Administration, Washington, DC.
AERONAUTICAL ENGINEERING: A CONTINUING BIBLIOGRAPHY WITH INDEXES (SUPPLEMENT 266)
Jun. 1991 175 p
(NASA-SP-7037(266); NAS 1.21:7037(266)) Avail: NTIS HC A08; NTIS standing order as PB89-914100, $10.50 domestic, $21.00 foreign CSCL 01B

This bibliography lists 645 reports, articles, and other documents introduced into the NASA scientific and technical information system in May 1991. Subject coverage includes: design, construction and testing of aircraft and aircraft engines; aircraft components, equipment and systems; ground support systems; and theoretical and applied aspects of aerodynamics and general fluid dynamics. Author

N91-27123# National Transportation Safety Board, Washington, DC.
ANNUAL REVIEW OF AIRCRAFT ACCIDENT DATA, US GENERAL AVIATION, CALENDAR YEAR 1988
27 Mar. 1991 88 p
(PB91-156851; NTSB/ARG-91/01) Avail: NTIS HC/MF A05 CSCL 01A

A statistical compilation and review of general aviation accidents which occurred in 1988 in the United States, its territories and possessions, and in international waters are presented. The accidents reported are all those involving U.S. registered aircraft not conducting operations under 14 CFR 121, 14 CFR 125, 14 CFR 127, or 14 CFR 135. The report is divided into five sections: All Accidents; Fatal Accidents; Serious injury Accidents; Property Damage Accidents and Midair Collision Accidents. Several tables present accident parameters for 1988 accidents only, and each section includes tabulations which present comparative statistics for 1988 and for the five-year period 1983 to 1987. GRA

02 AERODYNAMICS

Includes aerodynamics of bodies, combinations, wings, rotors, and control surfaces; and internal flow in ducts and turbomachinery.

For related information see also *34 Fluid Mechanics and Heat Transfer.*

N91-27124*# National Aeronautics and Space Administration. Langley Research Center, Hampton, VA.
EFFECTS OF YAW ANGLE AND REYNOLDS NUMBER ON RECTANGULAR-BOX CAVITIES AT SUBSONIC AND TRANSONIC SPEEDS
E. B. Plentovich, Julio Chu, and M. B. Tracy Washington Jul. 1991 54 p
(NASA-TP-3099; L-16847; NAS 1.60:3099) Avail: NTIS HC/MF A04 CSCL 01A

An experimental investigation was conducted to determine the effect of Reynolds number (separate from boundary layer thickness) and the effect of yaw angle on the pressure distribution in a rectangular-box cavity. The cavity (11.25 in. long and 2.5 in. wide) was tested over a Mach number range from 0.20 to 0.90, unit Reynolds numbers from 2 x 10(exp 6) to 100 x 10(exp 6) per foot and at yaw angles of 0 and 15 degrees. Cavities were tested with length-to-height ratios (l/h) of 4.4, 6.7, 12.67, and 20.0. Fluctuating and static pressure data are presented. The cavity model was mounted in the sidewall of the NASA, Langley 0.3-meter transonic cryogenic tunnel. The thickness of the sidewall boundary layer entering the cavity was measured with a Pitot pressure rake and the tabulated values are provided. For the range of Reynolds numbers tested, Reynolds numbers had no significant effect on the static pressure distributions. The effect of yaw on the cavity pressure distribution was most pronounced when the flowfield was of the open type at yaw = 0 degrees. In such cases, the flowfield

became transitional when the cavity was positioned at yaw = 0 degrees. However, if the flowfield, at yaw = 0 degrees, was transitional or closed, the effect of 15 degree yaw on the pressure distribution was very minimal. The types of flow field observed for given ranges of cavity 1/h at supersonic conditions were shown to occur at different ranges of 1/h for subsonic and transonic conditions. Author

N91-27125 Pennsylvania State Univ., University Park.
LINEAR MODELS FOR THE SHOCK CELL STRUCTURE OF SUPERSONIC JETS WITH NONCIRCULAR EXIT GEOMETRIES Ph.D. Thesis
Thonse R. S. Bhat 1990 191 p
Avail: Univ. Microfilms Order No. DA9104852

The development of models to predict the shock structure of imperfectly expanded supersonic jets with noncircular exit geometry is discussed. Numerical methods to obtain solutions for these models are also developed. Two different models to predict the shock cell structure are developed using a linearized analysis. The Vortex-Sheet Shock Cell Model assumes that the jet mixing layer can be represented by a vortex-sheet. The boundary element method is used to predict the shock spacing and the frequency of the screech tones. The results are compared with analysis and experiment and it is shown that agreement is good. The second model, the Finite Thickness Shear Layer Model, takes into account the finite thickness of the jet shear layer and the effects of the turbulence. Two different numerical schemes are developed to obtain predictions using this model. In the first method, a body-fitted coordinate system is used to set up the governing equations. The second numerical method uses a series of conformal mappings to transform the physical space to a rectangular computational domain. The results obtained are in reasonable agreement with the experimental data. This is especially true for the gross features of the shock cells. Dissert. Abstr.

N91-27126*# California Polytechnic State Univ., San Luis Obispo.
A WATER TUNNEL FLOW VISUALIZATION STUDY OF THE VORTEX FLOW STRUCTURES ON THE F/A-18 AIRCRAFT Final Report, 1 Jul. 1989 - 31 Mar. 1991
Doral R. Sandlin and Edgar J. Ramirez Jul. 1991 124 p
(Contract NCC2-620)
(NASA-CR-186938; NAS 1.26:186938) Avail: NTIS HC/MF A06 CSCL 01A

The vortex flow structures occurring on the F/A-18 aircraft at high angles of attack were studied. A water tunnel was used to gather flow visualization data on the forebody vortex and the wing leading edge extension vortex. The longitudinal location of breakdown of the leading edge vortex was found to be consistently dependent on the angle of attack. Other parameters such as Reynolds number, model scale, and model fidelity had little influence on the overall behavior of the flow structures studied. The lateral location of the forebody vortex system was greatly influenced by changes in the angle of sideslip. Strong interactions can occur between the leading edge extension vortex and the forebody vortex. Close attention was paid to vortex induced flows on various airframe components of the F/A-18. Reynolds number and angle of attack greatly affected the swirling intensity, and therefore the strength of the studied vortices. Water tunnel results on the F/A-18 correlated well with those obtained in similar studies at both full and sub scale levels. The water tunnel can provide, under certain conditions, good simulations of realistic flows in full scale configurations. Author

N91-27127*# National Aeronautics and Space Administration. Langley Research Center, Hampton, VA.
NASP AEROSERVOTHERMOELASTICITY STUDIES
Robert V. Doggett, Jr., Rodney H. Ricketts, T. E. Noll, and John B. Malone Apr. 1991 26 p
(NASA-TM-104058; NAS 1.15:104058) Avail: NTIS HC/MF A03 CSCL 01A

Some illustrative results obtained from work accomplished under the aerothermoelasticity work breakdown structure (WBS) element of the National Aerospace Plane (NASP) Technology Maturation Program (TMP) are presented and discussed. The objectives of the aerothermoelasticity element were to develop analytical methods applicable to aerospace plane type configurations, to conduct analytical studies to identify potential problems, to evaluate potential solutions to problems, and to provide an experimental data base to verify codes and analytical trends. Work accomplished in the three areas of experimental data base, unsteady aerodynamics, and integrated analysis methodology are described. Some of the specific topics discussed are: (1) transonic wind tunnel aeroelastic model tests of cantilever delta wing models, of an all-moveable delta-wing model, and of aileron buzz models; (2) unsteady aerodynamic theory correlation with experiment and theory improvements; and (3) integrated analysis methodology results for thermal effects on vibration, for thermal effects on flutter, and for improving aeroelastic performance by using active controls. Author

N91-27128*# National Aeronautics and Space Administration. Langley Research Center, Hampton, VA.
SUGGESTIONS FOR CAP-TSD MESH AND TIME-STEP INPUT PARAMETERS
Samuel R. Bland Jun. 1991 24 p
(NASA-TM-104083; NAS 1.15:104083) Avail: NTIS HC/MF A03 CSCL 01A

Suggestions for some of the input parameters used in the CAP-TSD (Computational Aeroelasticity Program-Transonic Small Disturbance) computer code are presented. These parameters include those associated with the mesh design and time step. The guidelines are based principally on experience with a one-dimensional model problem used to study wave propagation in the vertical direction. Author

N91-27129*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, OH.
AN EXPERIMENTAL TRACE GAS INVESTIGATION OF FLUID TRANSPORT AND MIXING IN A CIRCULAR-TO-RECTANGULAR TRANSITION DUCT
B. A. Reichert, W. R. Hingst, and T. H. Okiishi (Iowa State Univ. of Science and Technology, Ames.) 1991 14 p Presented at the 27th Joint Propulsion Conference, Sacramento, CA, 24-27 Jun. 1991; sponsored by AIAA, SAE, ASME, and ASEE
(NASA-TM-104499; E-6356; NAS 1.15:104499; AIAA-91-2370)
Copyright Avail: NTIS HC/MF A03 CSCL 01A

An ethylene trace gas technique was used to map out fluid transport and mixing within a circular to rectangular transition duct. Ethylene gas was injected at several points in a cross stream plane upstream of the transition duct. Ethylene concentration contours were determined at several cross stream measurement planes spaced axially within the duct. The flow involved a uniform inlet flow at a Mach number level of 0.5. Statistical analyses were used to quantitatively interpret the trace gas results. Also, trace gas data were considered along with aerodynamic and surface flow visualization results to ascertain transition duct flow phenomena. Convection of wall boundary layer fluid by vortices produced regions of high total pressure loss in the duct. The physical extent of these high loss regions is governed by turbulent diffusion. Author

N91-27130*# Texas A&M Univ., College Station. Dept. of Aerospace Engineering.
AN INITIAL INVESTIGATION INTO METHODS OF COMPUTING TRANSONIC AERODYNAMIC SENSITIVITY COEFFICIENTS Semiannual Progress Report, Jan. - Jun. 1991
Leland A. Carlson Jul. 1991 39 p
(Grant NAG1-793)
(NASA-CR-188644; NAS 1.26:188644; TAMRF-5802-91-02)
Avail: NTIS HC/MF A03 CSCL 01A

Continuing studies associated with the development of the quasi-analytical (QA) sensitivity method for three dimensional transonic flow about wings are presented. Furthermore, initial results using the quasi-analytical approach were obtained and compared to those computed using the finite difference (FD)

approach. The basic goals achieved were: (1) carrying out various debugging operations pertaining to the quasi-analytical method; (2) addition of section design variables to the sensitivity equation in the form of multiple right hand sides; (3) reconfiguring the analysis/sensitivity package in order to facilitate the execution of analysis/FD/QA test cases; and (4) enhancing the display of output data to allow careful examination of the results and to permit various comparisons of sensitivity derivatives obtained using the FC/QA methods to be conducted easily and quickly. In addition to discussing the above goals, the results of executing subcritical and supercritical test cases are presented. Author

N91-27131*# Pennsylvania State Univ., University Park. Dept. of Aerospace Engineering.
ANALYSIS AND DESIGN OF PLANAR AND NON-PLANAR WINGS FOR INDUCED DRAG MINIMIZATION Semiannual Status Report, Dec. 1990 - Jun. 1991
Dennis M. Straussfogel and Mark D. Maughmer Jul. 1991 17 p
(Grant NAG1-1198)
(NASA-CR-188656; NAS 1.26:188656) Avail: NTIS HC/MF A03 CSCL 01A

Improvements in the aerodynamic efficiency of commercial transport aircraft will reduce fuel usage with subsequent reduced cost, both monetary and environmental. To this end, the current research is aimed at reducing the overall drag of these aircraft with specific emphasis on reducing the drag generated by the lifting surfaces. The ultimate goal of this program is to create a wing design methodology which optimizes the geometry of the wing for lowest total drag within the constraints of a particular design specification. The components of drag which must be considered include profile drag, and wave drag. Profile drag is dependent upon, among other things, the airfoil section and the total wetted area. Induced drag, which is manifested as energy left in the wake by the trailing vortex system is mostly a function of wing span, but also depends on other geometric wing parameters. Wave drag of the wing, important in the transonic flight regime, is largely affected by the airfoil section, wing sweep, and so forth. The optimization problem is that of assessing the various parameters which contribute to the different components of wing drag, and determining the wing geometry which generates the best overall performance for a given aircraft mission. The primary thrust of the research effort to date was in the study of induced drag. Results from the study are presented. Author

N91-27132*# National Aeronautics and Space Administration. Langley Research Center, Hampton, VA.
RWF ROTOR-WAKE-FUSELAGE CODE SOFTWARE REFERENCE GUIDE
John D. Berry (Army Aviation Systems Command, Hampton, VA.) Jul. 1991 38 p
(NASA-TM-104078; NAS 1.15:104078; AVSCOM-TR-91-B-008) Avail: NTIS HC/MF A03 CSCL 01A

The RWF (Rotor-Wake-Fuselage) code was developed from first principles to compute the aerodynamics associated with the complex flow field of helicopter configurations. The code is sized for a single, multi-bladed main rotor and any configuration of non-lifting fuselage. The mathematical model for the RWF code is based on the integration of the momentum equations and Green's theorem. The unknowns in the problem are the strengths of prescribed singularity distributions on the boundaries of the flow. For the body (fuselage) a surface of constant strength source panels is used. For the rotor blades and rotor wake a surface of constant strength doublet panels is used. The mean camber line of the rotor airfoil is partitioned into surface panels. The no-flow boundary condition at the panel centroids is modified at each azimuthal step to account for rotor blade cyclic pitch variation. The geometry of the rotor wake is computers at each time step of the solution. The code produces rotor and fuselage surface pressures, as well as the complex geometry of the evolving rotor wake. Author

N91-27133*# National Aeronautics and Space Administration. Langley Research Center, Hampton, VA.
STRUCTURAL DYNAMIC AND AEROELASTIC CONSIDERATIONS FOR HYPERSONIC VEHICLES
F. W. Cazier, Jr., Robert V. Doggett, Jr., and Rodney H. Ricketts Jun. 1991 15 p Presented at AIAA/ASME/ASCE/AHS/ASC 32d Structures, Structural Dynamics, and Materials Conference, Baltimore, MD, 8-10 Apr. 1991 Previously announced as A91-32133
(NASA-TM-104110; NAS 1.15:104110) Avail: NTIS HC/MF A03 CSCL 01A

The specific geometrical, structural, and operational environment characteristics of hypersonic vehicles are discussed with particular reference to aerospace plane type configurations. A discussion of the structural dynamic and aeroelastic phenomena that must be addressed for this class of vehicles is presented. These phenomena are in the aeroservothermoelasticity technical area. Some illustrative examples of recent experimental and analytical work are given. Some examples of current research are pointed out. Author

N91-27134# ViaSat, Inc., Carlsbad, CA.
LIGHTWEIGHT PAYLOAD FOR HIGH ALTITUDE BALLOONS Final Technical Report, 20 Jul. 1990 - 21 May 1991
Mark J. Miller 21 May 1991 45 p
(Contract DAAH01-90-C-0616; ARPA Order 5916)
(AD-A236242) Avail: NTIS HC/MF A03 CSCL 25/2

This report addresses the design and operational concepts of an expendable 5 pound payload for a high altitude balloon or unmanned air vehicle. This payload consists of antenna, battery, and electronics and will serve as a satellite surrogate to provide communications in the UHF frequency band using existing off the shelf UHF radios. The transponder is an 18 MHz wideband architecture which will enable spread spectrums techniques as well as standard UHF narrow band communications. The payload is designed to operate at altitudes from 10,000 ft to 100,000 ft providing communications services within a 150 nmi radius for a duration in excess of 30 hours. The report shows a maximum aggregate throughput of 1.2 Mbps at a 30,000 ft altitude and 140 kbps at an altitude of 100,000 ft. It also presents two effective power control techniques that enable this throughput be achieved. This throughput can result in well over 100 narrowband users. The report is organized as follows. Section 1 is a brief introduction. Section 2 discusses the architectural design and the operational requirements that influence the design. Section 3 presents the design details, tradeoffs, and analysis that were performed during the design. Section 4 discusses the operational concepts and the power control techniques to be employed. GRA

N91-27135# Titan Systems, Inc., Princeton, NJ.
CONCEPTS FOR CAVITATION ALLEVIATION OF BANDED AND DUCTED ROTOR TIPS Final Report
John E. Yates and Stephen F. Parker 15 Apr. 1991 5 p
(Contract N00014-88-C-0269)
(AD-A236254) Avail: NTIS HC/MF A01 CSCL 13/10

This study explored concepts and recommend geometries for alleviating the cavitation sensitivity of blade-band junctions of banded and ducted underwater propellers. A lifting surface model of the tip region of the blade, the band and the duct wall was used to calculate in detail the blade load carry-over onto the band and the duct wall. Geometry modifications of the blade tip and the band camber were made to alleviate cavitation sensitivity. Two-dimensional models were used to assess the effect of blade and band thickness. Both design and analysis type codes were used. It is concluded that, with proper use of band camber, the suction pressure in the blade band junction can be tailored to alleviate cavitation. GRA

N91-27136# Air Force Astronautics Lab., Edwards AFB, CA.
SIMULATING THE VORTEX IN A SPINNING ROCKET Final Report, Jan. 1989 - Feb. 1991
Anjanette Knappenberger May 1991 47 p

(AF Proj. 5730)
(AD-A236345; AL-TR-90-070) Avail: NTIS HC/MF A03 CSCL 21/8

The continuing phenomena of coning in spin stabilized motor/spacecraft is investigated using a laboratory-scale vortex generating model. This model simulated some of the forces associated with a vortex flow and allowed for altering the relationship between the vortex core flow and the nozzle. Altering the vortex core centerline produced differences in the measured side forces. The first configuration, with the vortex center aligned with the nozzle, produced no disturbing side forces. In subsequent tests, the misalignment of the vortex centerline with the nozzle centerline produced a side force that deflected the model from the vertical reference. The tangential velocity of the forced vortex produced the disturbing moment on the model. Conclusions include: (1) For every configuration tested, a misalignment of the center of the vortex and the center of the nozzle resulted in a steady force exerted on the nozzle at a right angle to a line connecting the center of the vortex and the center of the nozzle and in the direction directed by the tangential velocity; (2) The magnitude of the produced force can be accurately predicted from simple momentum consideration. Summation at the entrance of the nozzle indicates that the force derives from turning the tangential flow 90 deg to exit the nozzle; (3) The primary dependent variable seems to be the magnitude of the tangential velocity of the gas at the exit nozzle; and (4) Preliminary tests to simulate a submerged nozzle show the submerged nozzle does not appreciatively change the side force magnitude or the direction. GRA

N91-27137# Arnold Engineering Development Center, Arnold Air Force Station, TN.
ULTRAVIOLET/VISIBLE SPECTRAL RADIANCE FOR THE BOW SHOCK OF A PROJECTILE LAUNCHED AT HIGH VELOCITIES IN THE AEDC TRACK G FACILITY Final Report, May 1989 - Jun. 1990
K. L. Dietz and W. K. McGregor May 1991 32 p
(Contract F40600-85-C-0026)
(AD-A236503; AEDC-TR-90-16) Avail: NTIS HC/MF A03 CSCL 19/1

An optical arrangement and detector gating scheme for viewing the bow shock spectral radiation from projectiles launched in a hypervelocity ballistic range are reported. Velocities were about 18,000 fps. Range pressure was 49 torr of dried air. A 0.32 m grating spectrometer with a linear array optical detector was used. Gating times of 275 and 100 microsec were employed to view nose cap radiation during the projectile's flight. The spectrum was dominated by a strong continuum in the visible with molecular band structure superimposed on it. The most dominant radiators in the UV were identified as the NO y bands and OH.N2 + First Negative, N2 Second Positive, CN, and NH were identified as emitters in the near-UV and VIS. In addition, there were many unidentified radiators in the VIS. GRA

N91-27138# Naval Postgraduate School, Monterey, CA.
A FLOW VISUALIZATION STUDY OF LEX GENERATED VORTICES ON A SCALE MODEL OF A F/A-18 FIGHTER AIRCRAFT AT HIGH ANGLES OF ATTACK M.S. Thesis
Odilon V. Cavazos, Jr. Jun. 1990 164 p
(AD-A236534) Avail: NTIS HC/MF A08 CSCL 01/1

A water tunnel flow visualization investigation was performed into the high angle of attach aerodynamics of a 2 percent scale model of the F/A-18 fighter aircraft. The main focus of this study was the effect of pitch rate on the development and bursting of vortices generated from the leading edge extension in the high angle of attack range with and without yaw. Results of this investigation indicate that the vortex bursting point (relative to the static case) moves rearward with increasing pitch-up motion and forward with increasing pitch-down motion. For the same pitch rate, vortex bursting was found to occur earlier for the pitch-down motion than for the pitch-up motion, implying aerodynamic hysteresis effects. Yawing the model generated significant vortex asymmetries due to the delayed vortex breakdown on the leeward side for yaw angles of less than 10 deg. The presence of these asymmetric vortices led to undesirable side forces and yawing moments. GRA

N91-27139* National Aeronautics and Space Administration. Langley Research Center, Hampton, VA.
SELECTABLE TOWLINE SPIN CHUTE SYSTEM Patent
Daniel M. Vairo, inventor (to NASA) and Raymond D. Whipple, inventor (to NASA) 4 Jun. 1991 22 p Filed 25 Oct. 1990
(NASA-Case-LAR-14322-1; US-Patent-5,020,739;
US-Patent-Appl-SN-603335; US-Patent-Class-244-75R;
US-Patent-Class-244-113; US-Patent-Class-244-139;
Int-Patent-Class-B64C-17/00) Avail: US Patent and Trademark Office CSCL 01A

An emergency spin recovery parachute is presented that is housed within a centrally mounted housing on the aft end of an aircraft and connected to a ring fitting within the housing. Two selectively latching shackles connected to separate towlines are openly disposed adjacent the ring fitting. The towlines extend in opposite directions from the housing along the aircraft wing to attachment points adjacent the wing-tips where the other end of each towline is secured. Upon pilot command, one of the open shackles latches to the ring fitting to attach the towline connected thereto, and a second command signal deploys the parachute. Suitable break-away straps secure the towlines to the aircraft surface until the parachute is deployed and the resulting force on the towline attached to the parachute overcomes the straps and permits the towline to extend to the point of attachment to exert sufficient drag on the spinning aircraft to permit the pilot to regain control of the aircraft. To employ the parachute as a drag chute to reduce landing speeds, both shackles and their respective towlines are latched to the ring fitting.
Official Gazette of the U.S. Patent and Trademark Office

N91-27140*# National Aeronautics and Space Administration. Langley Research Center, Hampton, VA.
SHOCK WAVE INTERACTION WITH AN ABRUPT AREA CHANGE
Manuel D. Salas Washington Aug. 1991 16 p
(NASA-TP-3113; L-16878; NAS 1.60:3113) Avail: NTIS HC/MF A03 CSCL 01A

The wave patterns that occur when a shock wave interacts with an abrupt area changed are analyzed in terms of the incident shock wave Mach number and area-jump ratio. The solutions predicted by a semi-similar models are in good agreement with those obtained numerically from the quasi-one-dimensional time-dependent Euler equations. The entropy production for the wave system is defined and the principle of minimum entropy production is used to resolve a nonuniqueness problem of the self-similar model. Author

N91-27141# Texas Technological Univ., Lubbock. Center for Applied Research and Engineering.
WIND DRAG COEFFICIENTS FOR OCTAGONAL CYLINDERS
Kishor C. Mehta, David L. Ritchie, and Walt Oler Mar. 1990 48 p Sponsored by Texas State Dept. of Highways and Public Transportation and Federal Highway Administration
(PB91-164475; TTU-RR-11-5-89-1207; FHWA/TX-90) Avail: NTIS HC/MF A03 CSCL 01A

Highway signs, luminaries, and traffic signal structures are exposed to wind loads throughout their lives. The design of the cross section, thus the amount of material and method of fabrication, very often is controlled by wind loads. Improved definitions of wind loads using drag coefficients make luminaries not only more economical but also more reliable. The Texas Department of Highways and Public Transportation sponsored a research project at Texas Tech University to determine drag coefficients for octagonal shaped luminarie supports. The research used the tow tank of the Mechanical Engineering Dept. at Texas Tech University for the experimental work. The experimental technique was verified using published data for circular cylinders. One of the innovations in the project was the use of actual industry manufactured luminarie poles as test specimens. These specimens

matched the surface roughness and the geometric parameters of field poles. Drag coefficient values obtained in the project are about 25 percent higher than ones currently specified in the AASHTO standard. GRA

03 AIR TRANSPORTATION AND SAFETY

Includes passenger and cargo air transport operations; and aircraft accidents.

For related information see also *16 Space Transportation* and *85 Urban Technology and Transportation.*

N91-27142# Federal Aviation Administration, Washington, DC. Air Traffic Rules and Procedures Service.
OBSTRUCTION MARKING AND LIGHTING
1 Aug. 1991 57 p
(AC-70/7460-1H) Avail: NTIS HC/MF A04

This Advisory Circular (AC) describes the Federal Aviation Administration's (FAA) standards for marking and lighting structures to promote aviation safety. The topics covered include: (1) administrative procedures; (2) marking; (3) lighting; (4) red obstruction lighting standards; (5) medium intensity flashing white lighting systems standards; (6) high intensity flashing white lighting systems standards; (7) dual lighting with red/medium intensity white systems; (8) dual lighting with red/high intensity flashing white systems; (9) marking and lighting catenary support structures with medium intensity flashing white lights; (10) marking and lighting catenary support structures with high intensity flashing white lights; (11) marking and lighting moored balloons and kites; and (12) marking and lighting equipment and information. Author

N91-27143# National Transportation Safety Board, Washington, DC.
ANNUAL REVIEW OF AIRCRAFT ACCIDENT DATA. US AIR CARRIER OPERATIONS, CALENDAR YEAR 1987
29 Nov. 1990 80 p
(PB91-119693; NTSB/ARC-90/01) Avail: NTIS HC/MF A05 CSCL 01C

The report is presented of aviation accidents involving revenue operations of U.S. Carriers including Commuter Air Carriers and On Demand Air Taxis for calendar year 1987. The report is divided into three major sections according to the Federal regulations under which the flight was conducted. In each section of the report tables are presented to describe the losses and characteristics of 1987 accidents to enable comparison with prior years. Author

N91-27144*# Miami Univ., Coral Gables, FL.
HUMAN FACTORS OF FLIGHT-DECK CHECKLISTS: THE NORMAL CHECKLIST
Asaf Degani (San Jose State Univ., CA.) and Earl L. Wiener May 1991 70 p
(Contract NCC2-377)
(NASA-CR-177549; A-90183; NAS 1.26:177549) Avail: NTIS HC/MF A04 CSCL 01C

Although the aircraft checklist has long been regarded as the foundation of pilot standardization and cockpit safety, it has escaped the scrutiny of the human factors profession. The improper use, or the non-use, of the normal checklist by flight crews is often cited as the probable cause or at least a contributing factor to aircraft accidents. An attempt is made to analyze the normal checklist, its functions, format, design, length, usage, and the limitations of the humans who must interact with it. The development of the checklist from the certification of a new model to its delivery and use by the customer are discussed. The influence of the government, particularly the FAA Principle Operations Inspector, the manufacturer's philosophy, the airline's culture, and the end user, the pilot, influence the ultimate design and usage of this device. The effects of airline mergers and acquisitions on checklist usage and design are noted. In addition, the interaction between production pressures and checklist usage and checklist management are addressed. Finally, a list of design guidelines for normal checklists is provided. Author

04 AIRCRAFT COMMUNICATIONS AND NAVIGATION

Includes digital and voice communication with aircraft; air navigation systems (satellite and ground based); and air traffic control.

For related information see also *17 Space Communications, Spacecraft Communications, Command and Tracking* and *Communications and Radar.*

N91-27145# Systems Control Technology, Inc., Arlington, VA.
DECISION-HEIGHT WINDOWS FOR DECELERATING APPROACHES IN HELICOPTERS: PILOT/VEHICLE FACTORS AND LIMITATIONS Final Report, Jan. 1989 - May 1991
R. H. Hoh, S. Baillie, S. Kereliuk, and J. J. Traybar (Federal Aviation Administration, Atlantic City, NJ.) Apr. 1991 63 p Prepared in cooperation with Hoh Aeronautics, Inc., Lomita, CA and Starmark Corp., Arlington, VA
(Contract DTFA01-87-C-00014; Work Order-5E)
(DOT/FAA/CT-90/14) Avail: NTIS HC/MF A04

A combined analysis and flight test program was conducted to investigate the characteristics of the decision height (DH) window for helicopter decelerating instrument approaches. The concept of an effective flight path angle has been employed to define the DH window in terms of basic rotorcraft performance data. Exploratory flight tests were conducted to validate this approach and to define the approximate dimensions of the DH window 50 feet above ground level. The flight test experiment included an instrument meteorological conditions (IMC) decelerating instrument approach with errors built into the flight director to cause the helicopter to arrive at the decision-height with some glideslope and groundspeed errors. The pilots were required to visually maneuver the rotorcraft from decision-height. The results indicate that the high speed boundary of the DH window is a function of the minimum usable torque, and related to maximum acceptable pitch altitude during deceleration. Some margin is required to account for pilot delay or control misapplication after breakout. The upper glideslope error boundary is based on the maximum negative aerodynamic flight path angle that can be flown at low airspeeds. Poor visual cuing after breakout tends to emphasize the need for margins from the helicopter performance. The low speed boundary of the DH window is based on rotorcraft handling qualities at very low airspeeds. The low glideslope boundary is dependent on obstruction avoidance and ability to see the heliport environment upon breakout at decision-height. Author

N91-27146# Federal Aviation Administration, Atlantic City, NJ.
NEW YORK AREA CONTROL FACILITY/METROPLEX CONTROL FACILITY VULNERABILITY ANALYSIS Technical Report, Oct. 1990 - Feb. 1991
Alfred L. Adkins and Arthur P. Pomerantz Apr. 1991 42 p
(Contract F-2006E)
(DOT/FAA/CT-TN91/21) Avail: NTIS HC/MF A03

The results are presented of an analysis of the impact of a New York Area Control Facility (ACF) or Metroplex Control Facility (MCF) failure under three different MCF configurations. This analysis was conducted using the National Airspace System Performance Analysis Capability (NASPAC) simulation model to assist ATR-310 and the Eastern Region on defining end-state configurations for the New York ACF/MCF. A discussion is presented of the facilities and procedures involved in an ACF/MCF failure along with the analysis approach, and the results of the analysis. Author

N91-27147# Massachusetts Inst. of Tech., Lexington. Lincoln Lab.
TRAFFIC ALERT AND COLLISION AVOIDANCE SYSTEM (TCAS). COCKPIT DISPLAY OF TRAFFIC INFORMATION (CDTI) INVESTIGATION. PHASE 1: FEASIBILITY STUDY Report, Feb. - Jun. 1990
John A. Sorensen, Walter Hollister, Malcolm Burgess, and Dean Davis Apr. 1991 97 p
(Contract F19628-85-C-0002)
(AD-A236109; DOT/FAA/RD-91/8) Avail: NTIS HC/MF A05 CSCL 01/5

The possibility of the TCAS traffic sensor and display being used for meaningful CDTI applications has resulted in the Federal Aviation Administration initiating a project to establish the technical and operational requirements to realize this potential. A summary is presented of Phase 1. Phase 1 was organized to define specific CDTI applications for aviation safety in the terminal area, to determine what was already learned about CDTI technology relevant to these applications, and to define the engineering required to supply the remaining TCAS-CDTI technology for capacity benefit realization. The CDTI applications examined were limited to those appropriate to the final; approach and departure phases of flight. With the advent of the TCAS II airborne collision avoidance system, an airborne display of surrounding aircraft traffic is about to become generally available in the cockpit. It was proposed that this cockpit display of traffic information provides the mechanism whereby flight crews can assist the controller in tightening the spacing tolerances that are maintained between adjacent aircraft for many phases of flight. GRA

N91-27148# Aeronautical Research Labs., Melbourne (Australia).
A DEMONSTRATION OF AN AIRCRAFT NAVIGATOR'S MOVING MAP DISPLAY
D. A. Craven Feb. 1991 20 p
(AD-A236833; ARL-Sys-TM-141; DODA-AR-006-081) Avail: NTIS HC/MF A03 CSCL 17/7

In the P3-C maritime patrol aircraft, the navigator is responsible for many communications related tasks while airborne, and as a result cannot afford to spend excessive time on his navigational duties. The concept of a low-cost Moving Map Display (MMD) as a navigator's aid has been proposed in order to minimize the time involved in assessing the aircraft's situation and identifying any deviations from the required course. The display should convey the aircraft's position, track and course (by means of pre-determined waypoints) superimposed on a map. It is required to be easily readable and involve minimal operator effort. A demonstrator of such a navigator's display has been developed and is incorporated into Flight Management Group's Programmable Cockpit. Aircraft position track and waypoint information are received via an RS232 serial line. Operator control the display is by a touch sensitive screen. Two map representations have been included in the demonstrator: a simple coast-only map (labelled Digital) onto which other features may be added in the future; and a more conventional digitized paper map. Since this display is intended for the navigator's station, north-up orientation of the map is sufficient. This simplifies the hardware requirements considerably as, unlike pilot-oriented heading-up displays, no image rotation is involved. GRA

N91-27149# Weapons Systems Research Lab., Adelaide (Australia).
A GENERIC INERTIAL NAVIGATION SYSTEM MODEL FOR COMPUTER SIMULATION STUDIES
D. A. Fogg and R. T. Janus Sep. 1990 41 p
(AD-A236849; WSRL-TM-30/90; DODA-AR-006-454) Avail: NTIS HC/MF A03 CSCL 17/7

A number of Inertial Navigation System (INS) models ranging from simple forced harmonic oscillator models to three-gyro, three-accelerometer systems were studied to ascertain a compromise between accuracy and computation time on the one hand and model complexity suitable for use in avionics system models for effectiveness studies on the other. INS position and orientation errors for various cruise and acceleration conditions were predicted by these models and the results shown graphically. The importance of various INS characteristics has been determined and the effects of the relevant error sources have been isolated and their propagation in time plotted. GRA

05 AIRCRAFT DESIGN, TESTING AND PERFORMANCE

Includes aircraft simulation technology.

For related information see also *18 Spacecraft Design, Testing and Performance* and *39 Structural Mechanics*. For land transportation vehicles see *85 Urban Technology and Transportation*.

N91-27150# Messerschmitt-Boelkow-Blohm G.m.b.H., Ottobrunn (Germany, F.R.). Hubschrauber und Flugzeuge.
MONOLITHIC CFC-MAIN LANDING GEAR DOOR FOR TORNADO
W. Hartmann, M. Michalak, and W. Pitzl 12 Dec. 1989 15 p Previously announced in IAA as A90-50136
(MBB/FE212/CFK/PUB/014/1; ETN-91-99250) Copyright Avail: NTIS HC/MF A03

The objective of the development program for the monolithic CFC Main Landing Gear Door (MLGD) is to produce fifteen lefthand CFC (Carbon Fiber Composite) MLGD's for long term in service testing on German air force Tornados to build up experience for the future European Fighter Aircraft (EFA). The CFC MLGD is designed with an internal spar-stringer structure covered by two skins and all these structural elements are made from Narmco 5245C/T800. The design and manufacturing work on the CFC MLGD are addressed and an outlook on the airworthiness testing and the planned in service test program is presented. ESA

N91-27151# Naval Air Development Center, Warminster, PA. Air Vehicle and Crew Systems Technology Dept.
FUNDAMENTALS AND METHODS OF HIGH ANGLE-OF-ATTACK FLYING QUALITIES RESEARCH Final Report, Jan. 1987 - Jan. 1988
Robert M. Seltzer and Glenn R. Rhodeside Jan. 1988 228 p
(AD-A235994; NADC-88020-60) Avail: NTIS HC/MF A11 CSCL 01/3

This report is intended: (1) for use as a collection and analysis of diverse data gathering, empirical, and analytical approaches to the high angle of attack aircraft stability and control problem; (2) as a compendium of several methods of defining aircraft departure and spin susceptibility; (3) as a reference for spin definition and spin recovery enhancement; (4) as a review of specifications, regulations, and design guides as they pertain to high angle of attack flight; and (5) as a medium for expounding where tomorrow's high angle of attack investigative attention should focus. The design of safe, effective fighter aircraft in the high angle of attack combat environment is reaching a critical point. Accepted flying qualities design guidelines (necessary to establish stability and control requirements) must be established to address flight operations in the high angle of attack flight regime. Most of the research to date has focused on aircraft departure. Parameters/criteria to define desired high angle of attack flying qualities in the post-stall region (outside the realm of departure) are still unanswered. GRA

N91-27152# Aeronautical Research Labs., Melbourne (Australia).
A REVIEW OF AUSTRALIAN AND NEW ZEALAND INVESTIGATIONS ON AERONAUTICAL FATIGUE DURING THE PERIOD APRIL 1989 TO MARCH 1991 Aircraft Structures Report
G. S. Jost Apr. 1991 50 p
(AD-A236016; ARL-Struc-TM-578; DODA-AR-006-593) Avail: NTIS HC/MF A03 CSCL 01/3

Major topics discussed include the fatigue of both civil and military aircraft structures, fatigue damage detection, analysis and

repair and fatigue life monitoring and assessment. Stress analysis of thermoelasticity, crack propagation, effects on fiber reinforced composites and stress strain relations are also reviewed. GRA

N91-27153# Aeronautical Research Labs., Melbourne (Australia).
F-111C FLIGHT DATA REDUCTION AND ANALYSIS PROCEDURES Flight Mechanics Report
M. I. Cooper, J. S. Drobik, and C. A. Martin Dec. 1990 104 p
(AD-A236025; ARL-Flight-Mech-R-187; DODA-AR-005-639)
Avail: NTIS HC/MF A06 CSCL 01/1

A series of flight trials was performed on the F-111C aircraft at the RAAF's Aircraft Research and Development Unit in February and October 1987. Data obtained from the tests were analyzed at the Aeronautical Research Laboratory to determine the aircraft aerodynamic and control derivatives. This report describes the methods and computer programs which are used to process and analyze the flight test data. Data handling procedures, pre-analysis flight data processing and the methods used to make corrections to air sensor measurements are described. Although the test program was conducted on a F-111C aircraft, with minor alterations the computer programs and procedures can be used for other aircraft test programs. GRA

N91-27154# Aeronautical Research Labs., Melbourne (Australia).
PROGRAMMABLE COCKPIT: INTER-COMPUTER COMMUNICATIONS AND DATA FLOW Aircraft Systems Technical Memorandum
D. A. Craven Mar. 1990 21 p
(AD-A236028; ARL-Sys-TM-139; DODA-AR-006-079) Avail: NTIS HC/MF A03 CSCL 01/3

The Programmable Cockpit is a multi computer system which is used for research into display design, cockpit layouts, crew workload and other human factors issues. It currently consists of four closely arranged screens onto which different cockpit instruments can be displayed, all driven from a common aircraft model. This provides a test-bed for determining the effectiveness of new or modified instruments, as they can be assessed in an environment simulating the cockpit as a whole. The system incorporates a distributed processing network of five processors, each performing a distinctive part of the simulation. The tasks are broken up as follows: FDM (Flight Dynamic Model); CD (Control Display); HUD (Head Up Display); HDD (Head Down Display); and MMD (Moving Map Display). GRA

N91-27155# National Aeronautics and Space Administration. Langley Research Center, Hampton, VA.
EVALUATION OF THE CONCEPT OF PRESSURE PROOF TESTING FUSELAGE STRUCTURES
Charles E. Harris and Oscar Orringer Jul. 1991 8 p
(DOT/FAA/CT-TN91/31) Avail: NTIS HC/MF A02

The FAA and NASA have recently completed independent technical evaluations of the concept of pressure proof testing the fuselage of commercial transport airplanes. The results of these evaluations are summarized. The objectives of the evaluations were to establish the potential benefit of the pressure proof test, to quantify the most desirable proof test pressure, and to quantify the required proof test interval. The focus of the evaluations was on multiple-site cracks extending from adjacent rivet holes of a typical fuselage longitudinal lap splice joint. The FAA and NASA do not support pressure proof testing the fuselage of aging commercial transport aircraft. The argument against proof testing is as follows: (1) a single proof test does not insure an indefinite life; therefore, the proof test must be repeated at regular intervals; (2) for a proof factor of 1.33, the required proof test interval must be below 300 flights to account for uncertainties in the evaluation; (3) conducting the proof test at a proof factor of 1.5 would considerably exceed the fuselage design limit load; therefore, it is not consistent with accepted safe practices; and (4) better safety can be assured by implementing enhanced nondestructive inspection requirements, and adequate reliability can be achieved by an inspection interval several times longer than the proof test interval. Author

N91-27156* National Aeronautics and Space Administration. Langley Research Center, Hampton, VA.
PASSIVE VENTING TECHNIQUE FOR SHALLOW CAVITIES Patent
Robert L. Stallings, Jr., inventor (to NASA) and Floyd J. Wilcox, Jr., inventor (to NASA) 28 May 1991 11 p Filed 28 Sep. 1988
(NASA-Case-LAR-13875-1; US-Patent-5,018,688;
US-Patent-Appl-SN-250468; US-Patent-Class-244-137.4;
US-Patent-Class-244-118.1; US-Patent-Class-244-130;
Int-Patent-Class-B64C-7/00; Int-Patent-Class-B64D-1/02) Avail: US Patent and Trademark Office CSCL 01C

A device is disclosed for reducing drag and store separation difficulties caused by shallow cavities on aircraft in supersonic flight consisting of a slab of porous material cut to fit precisely inside the cavity. This slab is mounted inside the cavity such that a plenum chamber is formed between the slab and the floor of the cavity. This device allows air to flow through the chamber opposite to the direction of flow outside the chamber. This results in reduced drag and improved store separation characteristics.
Official Gazette of the U.S. Patent and Trademark Office

06 AIRCRAFT INSTRUMENTATION

Includes cockpit and cabin display devices; and flight instruments.

For related information see also *19 Spacecraft Instrumentation* and *35 Instrumentation and Photography.*

N91-27157*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, OH.
THE NASA LEWIS INTEGRATED PROPULSION AND FLIGHT CONTROL SIMULATOR
Michelle M. Bright and Donald L. Simon 1991 13 p Presented at the Flight Simulation Technologies Conference, New Orleans, LA, 12-14 Aug. 1991; spons ored by AIAA
(NASA-TM-105147; E-6423; NAS 1.15:105147;
AVSCOM-TR-91-C-037) Avail: NTIS HC/MF A03 CSCL 14B

A new flight simulation facility was developed at NASA-Lewis. The purpose of this flight simulator is to allow integrated propulsion control and flight control algorithm development and evaluation in real time. As a preliminary check of the simulator facility capabilities and correct integration of its components, the control design and physics models for a short take-off and vertical landing fighter aircraft model were shown, with their associated system integration and architecture, pilot vehicle interfaces, and display symbology. The initial testing and evaluation results show that this fixed based flight simulator can provide real time feedback and display of both airframe and propulsion variables for validation of integrated flight and propulsion control systems. Additionally, through the use of this flight simulator, various control design methodologies and cockpit mechanizations can be tested and evaluated in a real time environment. Author

07 AIRCRAFT PROPULSION AND POWER

Includes prime propulsion systems and systems components, e.g., gas turbine engines and compressors; and onboard auxilliary power plants for aircraft.

For related information see also *20 Spacecraft Propulsion and Power, 28 Propellants and Fuels,* and *44 Energy Production and Conversion.*

N91-27158*# Michigan Technological Univ., Houghton.
DEFORMATION ANALYSIS OF ROTARY COMBUSTION ENGINE HOUSINGS Final Report
Carl Vilmann 1991 361 p

(Grant NAG3-456)
(NASA-CR-188187; NAS 1.26:188187) Avail: NTIS HC/MF A16 CSCL 21E

This analysis of the deformation of rotary combustion engine housings targeted the following objectives: (1) the development and verification of a finite element model of the trochoid housing, (2) the prediction of the stress and deformation fields present within the trochoid housing during operating conditions, and (3) the development of a specialized preprocessor which would shorten the time necessary for mesh generation of a trochoid housing's FEM model from roughly one month to approximately two man hours. Executable finite element models were developed for both the Mazda and the Outboard Marine Corporation trochoid housings. It was also demonstrated that a preprocessor which would hasten the generation of finite element models of a rotary engine was possible to develop. The above objectives are treated in detail in the attached appendices. The first deals with finite element modeling of a Wankel engine center housing, and the second with the development of a preprocessor that generates finite element models of rotary combustion engine center housings. A computer program, designed to generate finite element models of user defined rotary combustion engine center housing geometries, is also included. Author

N91-27159*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, OH.
EFFECT OF TABS ON THE EVOLUTION OF AN AXISYMMETRIC JET
K. B. M. Q. Zaman, M. Samimy, and M. F. Reeder (Ohio State Univ., Columbus.) 1991 14 p Presented at the Eighth Symposium on Turbulent Shear Flows, Munich, Fed. Republic of Germany, 9-11 Sep. 1991; sponsored by the Technical Univ. of Munich
(NASA-TM-104472; E-6125; NAS 1.15:104472) Avail: NTIS HC/MF A03 CSCL 21E

The effect of vortex generators, in the form of small tabs at the nozzle exit, on the evolution of an axisymmetric jet was investigated experimentally over a jet Mach number range of 0.34 to 1.81. The effects of one, two, and four tabs were studied in comparison with the corresponding case without a tab. Each tab introduced an indentation in the shear layer, apparently through the action of streamwise vortices which appeared to be of the trailing vortex type originating from the tips of the tab rather that of the necklace vortex type originating from the base of the tab. The resultant effect of two tabs, placed at diametrically opposite locations, was to essentially bifurcate the jet. The influence of the tabs was essentially the same at subsonic and supersonic conditions indicating that compressibility has little to do with the effect. Author

N91-27160*# Cleveland State Univ., OH. Dept. of Mechanical Engineering.
TESTING, ANALYSIS, AND CODE VERIFICATION OF AERODYNAMICS AND HEAT TRANSFER RELATED TO TURBOMACHINERY Final Report
Paul I. King 15 Jul. 1991 18 p
(Contract NCC3-195)
(NASA-CR-188640; NAS 1.26:188640; ORS-KGG-R1) Avail: NTIS HC/MF A03 CSCL 21E

Discussed here are the writing of a data acquisition code and the installation and testing of new pressure and temperature instrumentation to be used in the testing and evaluation of miniature heat flux sensors. A brief summary of the problem which led to the need for these tests is presented as well as a proposed data acquisition program and the results of investigations of two measurement systems, the Omega OM-900 temperature sensing system and the Scani-Valve Hyscan pressure measurement system. Author

N91-27161# Textile Technologies, Inc., Hatboro, PA.
ANGULAR WEAVING FOR TURBINE ENGINE COMPOSITE COMPONENTS Final Report, 1 Aug. 1987 - 29 Apr. 1988
Stephen P. Zawislak May 1991 38 p
(Contract F33615-87-C-2793)
(AD-A236288; WL-TR-91-2045) Avail: NTIS HC/MF A03 CSCL 11/5

Two dimensional fabrics of woven graphite tows represent the structural backbone of present aerospace composite parts. These fabrics are comprised of 0 and 90 degree systems of yarns, X and Y respectively. They are flat planar structures produced on conventional weaving looms. As advanced composite materials find use in more critical aircraft components, more stringent requirements are placed on reinforcing yarns and fabrics. Textile loom design has not kept pace with the use of composite materials. There has never been a loom designed specifically for weaving high modulus (graphite, ceramics, etc.) yarns into fabrics. The overall objective of this program was to advance the level of materials and processing techniques for high temperature polymeric, metal matrix composites and ceramic matrix composites. The major emphasis of this work was directed towards developing a composite reinforcement fabrication system, specifically, a machine design study focused on designing a loom or loom adaptation capable of integrally weaving four or more directions of yarn (multi-angular weaving). GRA

N91-27162# Washington Univ., Seattle.
RESONANT JETS FOR TURBINE COOLING Final Report, Jan. 1989 - Feb. 1991
M. Kurosaka 25 Apr. 1991 24 p
(Contract F49620-88-C-0041)
(AD-A236755; AFOSR-91-0512TR) Avail: NTIS HC/MF A03 CSCL 21/5

The objective of this investigation is to enhance the effectiveness of jet-impingement cooling, used in the hot turbine sections of jet aircraft engines, by exploiting the recently recognized capacity of the large-scale structures to alter the total temperature of jets. In this report, the results obtained from a newly constructed air-jet facility and from a water-jet test rig built separately for flow visualization study are described. In each, a jet discharged from a circular nozzle impinges on a plate. The results appear to substantiate the following speculations previously advanced: The secondary vortices, which are induced by the bombardment of the primary vortices formed initially by the nozzle exhaust, are responsible for the cooling on the impingement surface. The degree of cooling is, however, significantly affected by the competition between the primary and secondary vortices and the occurrence of acoustic resonance. The effect of the curvature of the impingement plate and the jet Mach number is also described. GRA

N91-27163*# ISTAR, Inc., Santa Monica, CA.
DETONATION DUCT GAS GENERATOR DEMONSTRATION PROGRAM Final Report
Andrew Wortman, Gayl A. Brinlee, Peter Othmer, and Michael A. Whelan Jun. 1991 168 p
(Contract NAS3-25453)
(NASA-CR-187137; NAS 1.26:187137) Avail: NTIS HC/MF A08 CSCL 21E

The feasibility of the generation of detonation waves moving periodically across high speed channel flow is experimentally demonstrated. Such waves are essential to the concept of compressing requirements and increasing the engine pressure compressor with the objective of reducing conventional compressor requirements and increasing the engine thermodynamic efficiency through isochoric energy addition. By generating transient transverse waves, rather than standing waves, shock wave losses are reduced by an order of magnitude. The ultimate objective is to use such detonation ducts downstream of a low pressure gas turbine compressor to produce a high overall pressure ratio thermodynamic cycle. A 4 foot long, 1 inch x 12 inch cross-section, detonation duct was operated in a blow-down mode using compressed air reservoirs. Liquid or vapor propane was injected through injectors or solenoid valves located in the plenum or the duct itself. Detonation waves were generated when the mixture was ignited by a row of spark plugs in the duct wall. Problems with fuel injection and mixing limited the air speeds to about Mach

0.5, frequencies to below 10 Hz, and measured pressure ratios of about 5 to 6. The feasibility of the gas dynamic compression was demonstrated and the critical problem areas were identified.
Author

N91-27164*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, OH.
MODERN CFD APPLICATIONS FOR THE DESIGN OF A REACTING SHEAR LAYER FACILITY
S. T. Yu (Sverdrup Technology, Inc., Brook Park, OH.), C. T. Chang, and C. J. Marek 1991 13 p Presented at the 29th Aerospace Sciences Meeting, Reno, NV, 7-10 Jan. 1991; sponsored by AIAA Previously announced in IAA as A91-21540
(Contract NAS3-25266)
(NASA-TM-104523; E-6396; NAS 1.15:104523; AIAA-91-0577)
Avail: NTIS HC/MF A03 CSCL 21E

The RPLUS2D code, capable of calculating high speed reacting flows, was adopted to design a compressible shear layer facility. In order to create reacting shear layers at high convective Mach numbers, hot air streams at supersonic speeds, rendered by converging-diverging nozzles, must be provided. A finite rate chemistry model is used to simulate the nozzle flows. Results are compared with one-dimensional solutions at chemical equilibrium. Additionally, a two equation turbulence model with compressibility effects was successfully incorporated with the RPLUS code. The model was applied to simulate a supersonic shear layer. Preliminary results show favorable comparisons with the experimental data.
Author

N91-27165*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, OH.
ANALYTICAL COMBUSTION/EMISSIONS RESEARCH RELATED TO THE NASA HIGH-SPEED RESEARCH PROGRAM
H. Lee Nguyen 1991 12 p Presented at the 27th Joint Propulsion Conference, Sacramento, CA, 24-27 Jun. 1991; sponsored by AIAA, SAE, ASME, and ASEE
(NASA-TM-104521; E-6392; NAS 1.15:104521; AIAA-91-2252)
Avail: NTIS HC/MF A03 CSCL 21E

Increasing the pressure and temperature of the engines of new generation supersonic airliners increases the emissions of nitrogen oxides to a level that would have an adverse impact on the Earth's protective ozone layer. In the process of implementing low emissions combustor technologies, NASA Lewis Research Center has pursued a combustion analysis program to guide combustor design processes, to identify potential concepts of greatest promise, and to optimize them at low cost, with short turn-around time. The approach is to upgrade and apply advanced computer programs for gas turbine applications. Efforts have been made to improve the code capabilities of modeling the physics. Test cases and experiments are used for code validation. To provide insight into the combustion process and combustor design, two-dimensional and three-dimensional codes such as KIVA-II and LeRC 3D have been used. These codes are operational and calculations have been performed to guide low emissions combustion experiments.
Author

08 AIRCRAFT STABILITY AND CONTROL

Includes aircraft handling qualities; piloting; flight controls; and autopilots.

For related information see also *05 Aircraft Design, Testing and Performance.*

N91-27166 Salford Univ. (England).
ACTIVE CONTROL OF V/STOL AIRCRAFT Ph.D. Thesis
David John Frederick Hopper 1990 475 p
Avail: Univ. Microfilms Order No. BRD-91382

A controller design method is developed which alleviates pilot workload during transitions from jet-borne to fully wing-borne flight (and vice versa) for a V/STOL aircraft. The method is based upon a singular perturbation analysis which is used to expose the underlying dynamics of a closed-loop state-space system. New developments are described which allow high-order, dynamically complex parasitics, such as actuators, to be included in the design. Furthermore, the method gives the designer insight into the problem allowing tuning and engineering trade-offs to be performed intelligently with a two-way flow of design information. The end result is a robust high-gain multivariate controller. The method is applied to a representative non-linear time-varying aircraft simulation model. The necessary state-space matrices are obtained by linearizing the model at several different flight cases. This occurs over a wide flight envelope, from hover to 300 Kts, and consequently the multivariable control laws are implemented using gain scheduling. Finally, task tailored control and handling qualities requirements are derived for a V/STOL aircraft in the form of a design brief and subsequent controller design is presented.
Dissert. Abstr.

N91-27167*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, OH.
NEURAL NETWORK APPLICATION TO AIRCRAFT CONTROL SYSTEM DESIGN
Terry Troudet (Sverdrup Technology, Inc., Brook Park, OH.), Sanjay Garg, and Walter C. Merrill 1991 20 p Presented at the Guidance, Navigation and Control Conference, New Orleans, LA, 12-14 Aug. 1991; sponsored by AIAA
(NASA-TM-105151; E-6435; NAS 1.15:105151) Avail: NTIS HC/MF A03 CSCL 01C

The feasibility of using artificial neural networks as control systems for modern, complex aerospace vehicles is investigated via an example aircraft control design study. The problem considered is that of designing a controller for an integrated airframe/propulsion longitudinal dynamics model of a modern fighter aircraft to provide independent control of pitch rate and airspeed responses to pilot command inputs. An explicit model following controller using H infinity control design techniques is first designed to gain insight into the control problem as well as to provide a baseline for evaluation of the neurocontroller. Using the model of the desired dynamics as a command generator, a multilayer feedforward neural network is trained to control the vehicle model within the physical limitations of the actuator dynamics. This is achieved by minimizing an objective function which is a weighted sum of tracking errors and control input commands and rates. To gain insight in the neurocontrol, linearized representations of the nonlinear neurocontroller are analyzed along a commanded trajectory. Linear robustness analysis tools are then applied to the linearized neurocontroller models and to the baseline H infinity based controller. Future areas of research are identified to enhance the practical applicability of neural networks to flight control design.
Author

N91-27168*# Purdue Univ., West Lafayette, IN.
THE INTEGRATED MANUAL AND AUTOMATIC CONTROL OF COMPLEX FLIGHT SYSTEMS Final Technical Report, 1 Jan. 1980 - 30 Apr. 1989
David K. Schmidt (Arizona State Univ., Tempe.) 1 Aug. 1991 8 p
(Grant NAG4-1)
(NASA-CR-188664; NAS 1.26:188664) Avail: NTIS HC/MF A02 CSCL 01C

Research dealt with the general area of optimal flight control synthesis for manned flight vehicles. The work was generic; no specific vehicle was the focus of study. However, the class of vehicles generally considered were those for which high authority, multivariable control systems might be considered, for the purpose of stabilization and the achievement of optimal handling characteristics. Within this scope, the topics of study included several optimal control synthesis techniques, control-theoretic modeling of the human operator in flight control tasks, and the development of possible handling qualities metrics and/or measures of merit. Basic contributions were made in all these topics, including human operator (pilot) models for multi-loop tasks, optimal output feedback flight control synthesis techniques;

experimental validations of the methods developed, and fundamental modeling studies of the air-to-air tracking and flared landing tasks. Author

09 RESEARCH AND SUPPORT FACILITIES (AIR)

Includes airports, hangars and runways; aircraft repair and overhaul facilities; wind tunnels; shock tubes; and aircraft engine test stands.

For related information see also *14 Ground Support Systems and Facilities (Space).*

N91-27169*# National Aeronautics and Space Administration. Langley Research Center, Hampton, VA.
OVERVIEW OF THE APPLIED AERODYNAMICS DIVISION
Washington Jun. 1991 39 p
(NASA-TM-102698; NAS 1.15:102698) Avail: NTIS HC/MF A03 CSCL 14B

A major reorganization of the Aeronautics Directorate of the Langley Research Center occurred in early 1989. As a result of this reorganization, the scope of research in the Applied Aeronautics Division is now quite different than that in the past. An overview of the current organization, mission, and facilities of this division is presented. A summary of current research programs and sample highlights of recent research are also presented. This is intended to provide a general view of the scope and capabilities of the division. Author

N91-27170# Electronics Research Lab., Adelaide (Australia).
A LASER ECM AND ESM FACILITY
Shane A. Brunker, Robert J. Rossiter, and Kenneth J. Grant Jan. 1991 21 p
(AD-A236021; ERL-0549-RR; DODA-AR-006-500) Avail: NTIS HC/MF A03 CSCL 17/4

This research report discusses a laser electronic countermeasure and electronic support measure facility, which was developed to conduct electronic countermeasure and electron support measure investigations of electro-optic systems. Detailed attention has been drawn to atmospheric effects within the system, and criteria are discussed which are employed to evaluate conditions where such effects become significant. GRA

N91-27171# Aerospace Medical Div., Brooks AFB, TX.
HUMAN CENTRIFUGES IN RESEARCH AND TRAINING
Larry J. Meeker 1991 4 p
(AD-A236267; AL-JA-1991-0018) Avail: NTIS HC/MF A01 CSCL 23/2

The use of centrifuges for human research has been reported for almost 200 years. Centrifuges have been used for research, medical treatment, and training of flight crew. These centrifuges have been designed and built in a variety of configurations with arms as short as 1.5 m and as long as 15 m. Acceleration on a centrifuge is usually measured in Gs which is the acceleration divided by the standard acceleration of gravity. The forces encountered in a centrifuge are the simple application of Newton's Three Laws of Motion. Axes have been defined for G vectors in relation to the human body. These are designated Z (aligned with the spine), Y (left to right), and X (front to back). Most research and training is in Gz and there are two methods of maintaining alignment with that axis. The USAF is examining the possibility of building a large radius centrifuges (200 m or larger) on a track to avoid the inertia of such a long arm. This type of machine could have advantages over the conventional centrifuge. GRA

12 ASTRONAUTICS (GENERAL)

For extraterrestrial exploration see *91 Lunar and Planetary Exploration.*

N91-27172# RADEX, Inc., Bedford, MA.
A PARAMETRIC STUDY OF THE RELEASE OF CO2 IN SPACE Report, Dec. 1990 - Jan. 1991
A. Setayesh 31 Jan. 1991 22 p
(Contract F19628-89-C-0068)
(AD-A236271; RX-R-91011; PL-TR-91-2052; SR-6) Avail: NTIS HC/MF A03 CSCL 07/2

SOCRATES (Spacecraft/Orbiter Contamination Representation Accounting for Transiently Emitted Species), which has been developed to account for contamination on spacecraft, has been used to simulate the CO2 reaction with atomic oxygen and hydrogen at altitudes of 500 to 800 km. The computerized simulation shows that the reactions of H atoms with CO2 and O with CO2 generate measurable quantities of radiation at the fundamental frequencies of carbon monoxide and OH. The intensity of these emissions was studied as a function of altitude and time. GRA

N91-27187# Joint Publications Research Service, Arlington, VA.
REEVALUATION OF SPACE PROGRAM COSTS, PRIORITIES URGED
V. Golovachev *In its* JPRS Report: Science and Technology. USSR: Space 7 Feb. 1991 p 58-59 Transl. into ENGLISH from TRUD (Moscow, USSR), 2 Aug. 1990 p 3 (For primary document see N91-27183 19-18)
Avail: NTIS HC/MF A05

N91-28106*# Bowie State Univ., MD.
AUTOMATED ASSEMBLY IN SPACE
Sandanand Srivastava, Suren N. Dwivedi (West Virginia Univ., Morgantown.), Toh Teck Soon, Reddy Bandi, Soumen Banerjee, and Cecilia Hughes *In* Alabama A & M Univ., NASA-HBCU Space Science and Engineering Research Forum Proceedings 1989 p 313-32 (For primary document see N91-28063 19-99)
Avail: NTIS HC/MF A23 CSCL 22A

13 ASTRODYNAMICS

Includes powered and free-flight trajectories; and orbital and launching dynamics.

No abstracts in this category.

14 GROUND SUPPORT SYSTEMS AND FACILITIES (SPACE)

Includes launch complexes, research and production facilities; ground support equipment, e.g., mobile transporters; and simulators.

For related information see also *09 Research and Support Facilities (Air).*

N91-27173# Polytechnic Univ., Brooklyn, NY.
NOVEL SCHEMES FOR ELECTROMAGNETIC LAUNCHERS Final Report, 15 Apr. 1988 - 15 Jan. 1991
Zivan Zabar 30 Jan. 1991 228 p
(Contract DASG60-88-C-0047)
(AD-A235974) Avail: NTIS HC/MF A11 CSCL 20/7

The goal of this project is to continue the effort started in a previous contract (under the same sponsorship) in developing a new type of electromagnetic launcher. The basic idea is similar to that of the classical induction motor, and it is therefore called a linear induction launcher (LIL). It uses a non-contacting projectile which is stably centered (levitated) in the barrel during transit. The barrel consists of a sectionalized array of coils energized in

a polyphase fashion by a capacitor bank switched by solid-state and/or ignitron devices. For improved efficiency, a power conditioning system was conceived that sharply reduces the energy that remains stored in the capacitor bank after shot. Various theoretical models and computer simulation codes have been developed. The models and computer codes have been validated experimentally in three prototypes. Muzzle velocities up to 250 m/s have been achieved for a 130 gram projectile. GRA

N91-27174# Army Science Board, Washington, DC.
ELECTROMAGNETIC/ELECTROTHERMAL GUN TECHNOLOGY DEVELOPMENT Final Report, 18 Dec. 1989 - 20 Feb. 1991
Alvin R Eaton, Gary A. Thiele, Allen F. Grum, Meredith C. Gourdine, and Peter J. Weinberger 10 Dec. 1990 91 p
(AD-A236493) Avail: NTIS HC/MF A05 CSCL 19/6

The Army Science Board (ASB) was directed to monitor progress of the electromagnetic and/or electrothermal gun technology development program. All ASB responsibilities indicated in the Congressional directives and the Panel Terms of Reference were fulfilled. It is concluded that electric gun technology represents an area of long term importance to U.S. armed forces, with the potential to furnish a variety of applications; it is emphasized, however, that potential benefits can be realized only through a consistently funded program providing additional emphasis on the illumination of fundamental issues, the maturation of component technologies, and the identification of innovative system applications. GRA

N91-27175* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, OH.
FURNACE FOR TENSILE/FATIGUE TESTING Patent
Pamela K. Brindley, inventor (to NASA) 14 May 1991 11 p Filed 19 Mar. 1990
(NASA-Case-LEW-14848-1; US-Patent-5,015,825; US-Patent-Appl-SN-382885; US-Patent-Class-219-390; US-Patent-Class-73-826; US-Patent-Class-374-49; US-Patent-Class-374-50; Int-Patent-Class-F27B-5/14; Int-Patent-Class-F27D-11/10; Int-Patent-Class-G01N-3/08) Avail: US Patent and Trademark Office CSCL 14B

Mechanical properties of short test specimens are tested in tension and fatigue using an improved electrical resistance heating furnace having a short length that mounts between the grips of a typical testing machine. The furnace includes a ceramic inner liner having an oval cross section to reduce heat loss at the ends. The furnace is divided into a plurality of individually controlled heating zones. Provision is made to supply an inert gas to the volume around the specimen in the center of the furnace.
Official Gazette of the U.S. Patent and Trademark Office

N91-28079*# Jackson State Univ., MS.
JACKSON STATE UNIVERSITY'S CENTER FOR SPATIAL DATA RESEARCH AND APPLICATIONS: NEW FACILITIES AND NEW PARADIGMS
Bruce E. Davis and Gregory Elliot *In* Alabama A & M Univ., NASA-HBCU Space Science and Engineering Research Forum Proceedings 1989 p 90-95 (For primary document see N91-28063 19-99)
Avail: NTIS HC/MF A23 CSCL 14B

15 LAUNCH VEHICLES AND SPACE VEHICLES

Includes boosters; operating problems of launch/space vehicle systems; and reusable vehicles.

For related information see also *20 Spacecraft Propulsion and Power.*

N91-27176# RAND Corp., Santa Monica, CA.
US ACCESS TO SPACE LAUNCH VEHICLE CHOICES FOR 1990-2010 Interim Report
Scott N. Pace Mar. 1990 249 p
(Contract F49620-91-C-0003)
(AD-A236928; RAND/R-3820-AF) Avail: NTIS HC/MF A11 CSCL 22/2

Although studies of space transportation in recent years have spanned a wide range of issues, there have been few studies that compare both means and ends. This report evaluates launch vehicle combinations capable of meeting a range of U.S. space traffic needs between 1990 and 2010. The evaluation aims to clarify alternatives available to the United States in pursuing potential national goals and to increase understanding of the implications of those alternatives. The study method involved six steps: (1) review the space transportation planning process, current issues, and political factors; (2) define alternative levels of U.S. space traffic demand for 1990 to 2010; (3) create various combinations of existing and proposed launch vehicles to fulfill each demand level; (4) calculate costs and uncertainties; (5) interview space transportation planners on institutional criteria for evaluating launch vehicle mixes; and (6) evaluate launch vehicle options and recommend preferred U.S. actions in space transportation planning and procurement. GRA

N91-27177*# National Aeronautics and Space Administration. Langley Research Center, Hampton, VA.
TECHNOLOGY FOR THE FUTURE: IN-SPACE TECHNOLOGY EXPERIMENTS PROGRAM, PART 1
Roger A. Breckenridge, comp., Lenwood G. Clark, comp., Kelli F. Willshire, comp., Sherwin M. Beck, comp., and Lisa D. Collier, comp. (Computer Technology Associates, Inc., Hampton, VA.) Jun. 1991 304 p Workshop held in Atlanta, GA, 6-9 Dec. 1988
(NASA-CP-10073-Pt-1; NAS 1.55:10073-Pt-1) Avail: NTIS HC/MF A14 CSCL 22B

The purpose of the Office of Aeronautics and Space Technology (OAST) In-Space Technology Experiment Program (In-STEP) 1988 Workshop was to identify and prioritize technologies that are critical for future national space programs and require validation in the space environment, and review current NASA (In-Reach) and industry/university (Out-Reach) experiments. A prioritized list of the critical technology needs was developed for the following eight disciplines: structures; environmental effects; power systems and thermal management; fluid management and propulsion systems; automation and robotics; sensors and information systems; in-space systems; and humans in space. This is part one of two parts and is the executive summary and experiment description. The executive summary portion contains keynote addresses, strategic planning information, and the critical technology needs summaries for each theme. The experiment description portion contains brief overviews of the objectives, technology needs and backgrounds, descriptions, and development schedules for current industry, university, and NASA space flight technology experiments.
Author

N91-27178*# National Aeronautics and Space Administration. Langley Research Center, Hampton, VA.
TECHNOLOGY FOR THE FUTURE: IN-SPACE TECHNOLOGY EXPERIMENTS PROGRAM, PART 2
Roger A. Breckenridge, comp., Lenwood G. Clark, comp., Kelli F. Willshire, comp., Sherwin M. Beck, comp., and Lisa D. Collier, comp. (Computer Technology Associates, Inc., Hampton, VA.) Jun. 1991 304 p Workshop held in Atlanta, GA, 6-9 Dec. 1988
(NASA-CP-10073-Pt-2; NAS 1.55:10073-Pt-2) Avail: NTIS HC/MF A14 CSCL 22B

The purpose of the Office of Aeronautics and Space Technology (OAST) In-Space Technology Experiments Program In-STEP 1988 Workshop was to identify and prioritize technologies that are critical for future national space programs and require validation in the space environment, and review current NASA (In-Reach) and industry/ university (Out-Reach) experiments. A prioritized list of the critical technology needs was developed for the following eight disciplines: structures; environmental effects; power systems and thermal management; fluid management and propulsion systems; automation and robotics; sensors and information systems; in-space systems; and humans in space. This is part two of two parts and

contains the critical technology presentations for the eight theme elements and a summary listing of critical space technology needs for each theme. Author

N91-27179*# Boeing Co., Seattle, WA.
SYSTEMS INTEGRATION AND DEMONSTRATION OF ADVANCED REUSABLE STRUCTURE FOR ALS
Martin N. Gibbins Jun. 1991 132 p
(Contract NAS1-18560)
(NASA-CR-187509; NAS 1.26:187509) Avail: NTIS HC/MF A07 CSCL 22B

The objective was to investigate the potential of advanced material to achieve life cycle cost (LCC) benefits for reusable structure on the advanced launch system. Three structural elements were investigated - all components of an Advanced Launch System reusable propulsion/avionics module. Leading aeroshell configurations included sandwich structure using titanium, graphite/polyimide (Gr/PI), or high-temperature aluminum (HTA) face sheets. Thrust structure truss concepts used titanium, graphite/epoxy, or silicon carbide/aluminum struts. Leading aft bulkhead concepts employed graphite epoxy and aluminum. The technical effort focused on the aeroshell because the greatest benefits were expected there. Thermal analyses show the structural temperature profiles during operation. Finite element analyses show stresses during splash-down. Weight statements and manufacturing cost estimates were prepared for calculation of LCC for each design. The Gr/PI aeroshell showed the lowest potential LCC, but the HTA aeroshell was judged to be lower risk. A technology development plan was prepared to validate the applicable structural technology. Author

16 SPACE TRANSPORTATION

Includes passenger and cargo space transportation, e.g., shuttle operations; and space rescue techniques.

For related information see also *03 Air Transportation and Safety* and *18 Spacecraft Design, Testing and Performance.* For space suits see *54 Man/System Technology and Life Support.*

N91-27180*# National Aeronautics and Space Administration. Langley Research Center, Hampton, VA.
LAUNCH VEHICLE INTEGRATION OPTIONS FOR A LARGE EARTH SCIENCES GEOSTATIONARY PLATFORM CONCEPT
James L. Garrison and Lawrence F. Rowell Jul. 1991 49 p
(NASA-TP-3083; L-16819; NAS 1.60:3083) Avail: NTIS HC/MF A03 CSCL 22B

Concepts are derived for the packaging of the components of a large Earth sciences geostationary platform to be launched in either the Space Shuttle or the Titan IV Complementary Expendable Launch Vehicle. Geometric data from a proposed conceptual design for the spacecraft, antenna sizing results from thermal and structural finite element analysis, and independent mass and volume estimates are used to determine sizes, shapes, and masses of the major platform components and support equipment. Solid modeling software is utilized to evaluate proposed launch integration schemes in terms of meeting volume and mass constraints, checking for interference between components, verifying that center-of-gravity locations fall within vehicle specifications, and designing suitable interface structures which do not violate any of these constraints. Construction at Space Station Freedom is assumed, and a space-based orbital transfer vehicle is determined to be necessary for inserting the spacecraft, once assembled, into geostationary orbit. Author

N91-27181*# Texas Univ., Austin. Dept. of Aerospace Engineering and Engineering Mechanics.
TEST AND ANALYSIS PROCEDURES FOR UPDATING MATH MODELS OF SPACE SHUTTLE PAYLOADS Final Technical Report
Roy R. Craig, Jr. May 1991 66 p
(Grant NAG9-346)
(NASA-CR-185987; NAS 1.26:185987; CAR-91-2) Avail: NTIS HC/MF A04 CSCL 22B

Over the next decade or more, the Space Shuttle will continue to be the primary transportation system for delivering payloads to Earth orbit. Although a number of payloads have already been successfully carried by the Space Shuttle in the payload bay of the Orbiter vehicle, there continues to be a need for evaluation of the procedures used for verifying and updating the math models of the payloads. The verified payload math models is combined with an Orbiter math model for the coupled-loads analysis, which is required before any payload can fly. Several test procedures were employed for obtaining data for use in verifying payload math models and for carrying out the updating of the payload math models. Research was directed at the evaluation of test/update procedures for use in the verification of Space Shuttle payload math models. The following research tasks are summarized: (1) a study of free-interface test procedures; (2) a literature survey and evaluation of model update procedures; and (3) the design and construction of a laboratory payload simulator. Author

17 SPACE COMM., SPACECRAFT COMM., COMMAND & TRACKING

Includes telemetry; space communications networks; astronavigation and guidance; and radio blackout.

For related information see also *04 Aircraft Communications and Navigation* and *32 Communications and Radar.*

No abstracts in this category.

18 SPACECRAFT DESIGN, TESTING AND PERFORMANCE

Includes satellites; space platforms; space stations; spacecraft systems and components such as thermal and environmental controls; and attitude controls.

For life support systems see *54 Man/System Technology and Life Support.* For related information see also *05 Aircraft Design, Testing and Performance, 39 Structural Mechanics,* and *16 Space Transportation.*

N91-27182*# National Aeronautics and Space Administration. Langley Research Center, Hampton, VA.
PACKAGING, DEVELOPMENT, AND ON-ORBIT ASSEMBLY OPTIONS FOR LARGE GEOSTATIONARY SPACECRAFT
William T. Davis and Charles B. King (Bionetics Corp., Hampton, VA.) Washington Jul. 1991 34 p
(NASA-TP-3088; L-16863; NAS 1.60:3088) Avail: NTIS HC/MF A03 CSCL 22B

Large spacecraft, particularly in geostationary Earth orbit (GEO), require special attention to the design challenges of launch vehicle packaging, deployment, and/or on-orbit assembly. Design studies of two different GEO spacecraft required that packaging, deployment, and on-orbit assembly analyses be conducted to establish the viability of these concepts for future NASA missions. This study used these analyses as strawman concepts for an investigation of packaging, deployment, and on-orbit assembly techniques. It also revealed generic guidelines for in-space assembly and highlighted the importance of early integration of packaging, deployment, and on-orbit assembly requirements into the spacecraft design. The first of the study spacecraft were used to study the definition and analyses of on-orbit assembly options for large GEO spacecraft. The second study spacecraft required investigation of the feasibility of deploying large spacecraft at GEO. The second spacecraft was also used to examine the packaging requirements of a deployable spacecraft and the packaging

requirements for a hybrid assembled/deployable version of that spacecraft. This investigation was done with attention to minimum volume (and minimum launches) and to the relationship between packaging and spacecraft deployment and final configuration.
Author

N91-27183# Joint Publications Research Service, Arlington, VA.
JPRS REPORT: SCIENCE AND TECHNOLOGY. USSR: SPACE
7 Feb. 1991 78 p Transl. into ENGLISH from various Russian articles
(JPRS-USP-91-001) Avail: NTIS HC/MF A05

Abstracts of Soviet literature in various areas of the space sciences are compiled. The following subject areas are covered: manned mission highlights; space sciences; interplanetary sciences; space engineering; space applications; and space policy and administration. For individual titles, see N91-27184 through N91-27188.

N91-27184# Joint Publications Research Service, Arlington, VA.
SCIENTISTS' DISCOVERIES ON QUASARS, SUPERNOVAS NOTED **c89**
Veronika Romanenkova and Andrey Surzhanskiy *In its* JPRS Report: Science and Technology. USSR: Space 7 Feb. 1991 p 21-22 Transl. into ENGLISH from TASS (Moscow, USSR), 16 Nov. 1990 (For primary document see N91-27183 19-18)
Avail: NTIS HC/MF A05

The discovery made by Soviet astrophysicist Gennadiy Sholomitskiy and the method of research worked out by him allow to discover very small space objects and determine their dimensions and remoteness from the earth. The results of this discovery are successfully used during studies of continental movements, in the time service, and in resolving other applied tasks. Another discovery is also discussed. By comparing certain parts of spectrum of various astronomical objects, Yuriy Pskovskiy defined more precisely the nature of supernova stars and determined their physical characteristics. Author

N91-27185# Joint Publications Research Service, Arlington, VA.
RT-70 MILLIMETER RADIOTELESCOPE **c89**
L. M. Gindilis *In its* JPRS Report: Science and Technology. USSR: Space 7 Feb. 1991 p 22-27 Transl. into ENGLISH from Zemlya I Vselennaya (Moscow, USSR), no. 4, Jul. - Aug. 1990 p 26-31 (For primary document see N91-27183 19-18)
Avail: NTIS HC/MF A05

Construction of a radio astronomy observatory is under way on the Suffa Plateau in Uzbek SSR (USSR). The main instrument of the observatory will be the 70-meter RT-70 radiotelescope, which is designed for operation in the millimeter wavelength range. The following topics are included: prototype and modernization; optical configuration; adaptive surface; radioholographic adjustment; and scientific objectives. Author

N91-27186# Joint Publications Research Service, Arlington, VA.
RSFSR MINISTER OF SPACE AND COMMUNICATIONS INTERVIEWED
In its JPRS Report: Science and Technology. USSR: Space 7 Feb. 1991 p 52-53 Transl. into ENGLISH from Izvestiya (USSR), 23 Jul. 1990 p 2 (For primary document see N91-27183 19-18)
Avail: NTIS HC/MF A05

An interview with RSFSR Minister of Communications, Information Science, and Space is presented. The following subject areas are covered: space-based communication system of RSFSR; plans for launching three more Gorizont communication satellites; modernizing existing communication satellites; operation costs; and plans for platforms launching with powerful Energiya rocket.
Author

N91-27187# Joint Publications Research Service, Arlington, VA.
REEVALUATION OF SPACE PROGRAM COSTS, PRIORITIES URGED **c12**
V. Golovachev *In its* JPRS Report: Science and Technology. USSR: Space 7 Feb. 1991 p 58-59 Transl. into ENGLISH from TRUD (Moscow, USSR), 2 Aug. 1990 p 3 (For primary document see N91-27183 19-18)
Avail: NTIS HC/MF A05

The following subject areas are covered: Mir complex; EVAs; spaceborne experiments; cosmonauts' performance; costs of manned flights; the manned space programs; orbital assembly; and satellite communication. Author

N91-27188# Joint Publications Research Service, Arlington, VA.
US EXPERIENCE CITED TO URGE CHANGE IN SPACE PROGRAM MANAGEMENT **c81**
Vladimir Terekhov *In its* JPRS Report: Science and Technology. USSR: Space 7 Feb. 1991 p 59-62 Transl. into ENGLISH from Sovetskaya Rossiya (Moscow, USSR), 22 Aug. 1990 p 2 (For primary document see N91-27183 19-18)
Avail: NTIS HC/MF A05

The following subject areas are covered: comparison of Soviet and American space programs; NASA programs; cost estimates; space communication systems; budgeting of scientific programs; space program and national defense; and space policies in the U.S.S.R. Author

N91-27189# Sandia National Labs., Albuquerque, NM.
HARDNESS ASSURANCE FOR LOW-DOSE SPACE APPLICATIONS
D. M. Fleetwood, P. S. Winokur, and T. L. Meisenheimer 1991 5 p Presented at the IEEE Annual International Nuclear and Space Radiation Effects Conference, San Diego, 15-19 Jul. 1991
(Contract DE-AC04-76DP-00789)
(DE91-009179; SAND-91-0482C; CONF-910751-6) Avail: NTIS HC/MF A01

A simple test method for hardness assurance testing of metal oxide semiconductor (MOS) devices for low dose rate applications is outlined. The method provides a conservative estimate of MOS hardness in space, but allows greater latitude in device selection than the present MIL-STD. DOE

N91-27190# RAND Corp., Santa Monica, CA.
DIRECT BROADCAST SATELLITES: A COMPETITIVE ALTERNATIVE TO CABLE TELEVISION?
Leland L. Johnson and Deborah R. Castleman 1990 101 p Sponsored by Markle Foundation and Richard S. Leghorn
(RAND-R-4047-MF/RL; ISBN-0-8330-1132-4) Avail: NTIS HC/MF A06

An economic and engineering analysis of direct broadcast satellites' prospects for competing with cable television systems in the United States is presented. Other multichannel television alternatives to cable are briefly examined to assess the likelihood of competition from other directions. From this analysis, a number of issues relating to public policy are addressed. Author

N91-27191*# Texas A&M Univ., College Station. Dept. of Aerospace Engineering.
NONEQUILIBRIUM RADIATION AND CHEMISTRY MODELS FOR AEROCAPTURE VEHICLE FLOWFIELDS Semiannual Progress Report, Feb. - Jun. 1991
Leland A. Carlson Jul. 1991 140 p
(Grant NAG1-1003)
(NASA-CR-188646; NAS 1.26:188646; TAMRF-6382-91-02)
Avail: NTIS HC/MF A07 CSCL 22B

The primary tasks performed are: (1) the development of a second order local thermodynamic nonequilibrium (LTNE) model for atoms; (2) the continued development of vibrational nonequilibrium models; and (3) the development of a new multicomponent diffusion model. In addition, studies comparing these new models with previous models and results were conducted and reported. Author

N91-27192# Institute for Defense Analyses, Alexandria, VA.
TOPICS IN HYPERVELOCITY IMPACT SHIELDING FOR SPACE ASSETS Final Report, May - Oct. 1989
Peter Kysar Oct. 1990 64 p

(AD-A235810; AD-E501384; IDA-D-675; IDA/HQ-89-34916)
Avail: NTIS HC/MF A04 CSCL 19/10

The growing quantities of debris resulting from past and ongoing space operations pose an increasing threat to future space operations. Additional debris may result from anti-satellite (ASAT) weapons tests. The deployment of an ASAT pellet ring could place many tons of debris in space. The threat of debris to spacecraft, from whatever source, is a matter of increasing concern to both NASA and DoD. All future space operations must recognize the danger of space debris and suitable protection procedures must be provided. Protection from unreasonable debris damage requires an understanding of both the debris population and of the phenomena involved in hypervelocity impact. Collisions between objects orbiting the earth usually involve speeds in excess of the speeds acceptable for the classical collision regime. Collisions at such speeds have a little understood and a much debated complex phenomenology. The future development of space will require a greater understanding of hypervelocity issues. GRA

N91-27193# Lockheed Missiles and Space Co., Palo Alto, CA.
ONR-307 EXPERIMENT ON THE COMBINED RELEASE AND RADIATION EFFECTS SATELLITE (CRRES) Interim Technical Report, Jul. 1988 - Mar. 1991
R. M. Robinson and R. R. Vondrak 1 Mar. 1991 96 p
(Contract N00013-83-C-0476)
(AD-A236241) Avail: NTIS HC/MF A05 CSCL 22/1

The Combines Release and Radiation Effects Satellites (CRRES) geosynchronous transfer orbit with an apogee of 35,786 km makes it an ideal platform to study problems related to the radiation belts and its effects on spacecraft systems. The instrumentation on CRRES can be broadly divided into three categories: (1) engineering experiments, (2) radiation belt experiments, and (3) plasma and fields experiments. The ONR-307 payload consists of three different types of instruments that acquire data on the composition of the plasma in the energy range from 0.5 to 1000 keV and on energetic electrons from 20 to 5000 keV and protons from 500 keV to 100 MeV. The data from these instruments provide important information for modeling radiation belt particle populations and understanding the sources and losses of these particles. The ONR-307 instruments were initialized by August 7, 1990 and have been operating flawlessly throughout the CRRES mission. Initial results show that the data quality is excellent. A period of high magnetic activity in late August has been selected for detailed study by the CRRES science team. Data analysis is continuing and future efforts will concentrate on the validation of the data and coordinated measurements with other CRRES instruments. GRA

N91-27194# Total Army Personnel Agency (Provisional), Alexandria, VA.
HYPERSONIC AEROSPACE VEHICLE LEADING EDGE COOLING USING HEAT PIPE, TRANSPIRATION, AND FILM COOLING TECHNIQUES Ph.D. Thesis
James M. Modlin Jun. 1991 132 p
(AD-A236406) Avail: NTIS HC/MF A07 CSCL 22/1

An investigation was conducted to determine the feasibility of using liquid metal heat pipe, transpiration and film cooling techniques to cool aerospace vehicle leading edge structures exposed to severe, transient hypersonic flight aerodynamic heating environments. A finite difference, numerical cooling model was developed and applied to an aerospaceplane wing leading edge section and to a scramjet inlet section. It was demonstrated that these cooling techniques are feasible. GRA

N91-27195# American Astronautical Society, San Diego, CA.
DISCOVERY OF Be-7 ACCRETION IN LOW EARTH ORBIT: THE 16TH ANNUAL AAS GUIDANCE AND CONTROL CONFERENCE
G. W. Phillips, S. E. King, R. A. August, J. C. Ritter, and J. H. Cutchin 6 Feb. 1991 58 p Conference held in Keystone, CO, 2-6 Feb. 1991
(AD-A236614; AAS-91-076) Avail: NTIS HC/MF A04 CSCL 22/1

Strong Be-7 activity was observed on the surface of the Long Duration Exposure Facility (LDEF) during the first complete gamma ray survey of a large spacecraft after its return to earth. This is the first known evidence for accretion of a radioactive isotope onto an orbiting spacecraft. Be-7 is produced by spallation reactions of cosmic rays on nitrogen and oxygen in the upper atmosphere. However, the observed density is much greater than expected due to cosmic ray production in situ; this is significant for models of atmospheric mixing. Be-7 may be a valuable tracer in future studies of the upper atmosphere. Other isotopes seen during the survey, the strongest being Na-22, are due to activation of spacecraft components while in orbit. The likely accretion is discussed of other cosmic ray produced isotopes and their possible effects on spacecraft in low earth orbit. GRA

N91-27196# Naval War Coll., Newport, RI. Dept. of Operations.
AN INVESTIGATION INTO THE CAPABILITY OF CIVIL SATELLITES TO SUPPORT SELECTED OPERATIONAL-LEVEL IMAGING REQUIREMENTS Final Report
James V. Painter 11 Feb. 1991 42 p
(AD-A236873) Avail: NTIS HC/MF A03 CSCL 15/4

This paper examines the degree to which two hypothetical operational level imagery collection requirements can be satisfied by current and future civil imaging satellites. It is asserted that the operational level commander is singularly bereft of imagery surveillance resources keyed to his unique theater perspective and that civil satellites may contribute to derived shortfalls. The intent is to familiarize the reader with the resource and to generate thought regarding potential use of the civil systems to support questions. Necessary background information on the systems is provided and an analytic framework is developed. Key characteristics of the requirements in terms of imagery quantity, quality, and timeliness are evaluated against sensor performance specifications. The outcome suggests that integration of civil systems into operations is not a panacea. However, they are an essentially untapped resource which present advantages in performance, cost, political issues, and near term benefits when compared to more traditional solutions to unfulfilled requirements. GRA

N91-27197# Naval Postgraduate School, Monterey, CA.
SATELLITE SERVICING USING THE ORBITAL MANEUVERING VEHICLE IN LOW EARTH ORBIT M.S. Thesis
Anthony D. Cutri Jun. 1990 124 p
(AD-A236941) Avail: NTIS HC/MF A06 CSCL 22/1

The concept of servicing and repair of satellites in low earth orbit (LEO) using the Orbital Maneuvering Vehicle (OMV) is examined. It could be economically applied to any LEO in which sufficient numbers of satellites are located or where individual satellite cost/mission justify servicing. Increases in cost effectiveness and operational flexibility of in-space systems can be realized when the capability to replenish consumable fluids, propellants and Orbital Replacement Units (ORUs) are incorporated into satellite design. ORUs can be placed in orbit using expendable launch vehicles (ELV), specifically selected to satisfy the mission need. Several suitable small payload, low cost boosters are now under development, with attainment of operational status expected in the early 1990's. The concept calls for modular satellite design and deployment of a space based support platform. New technology could be applied in the form of upgrades and on orbit modifications much more efficiently than the current abandon/replace policy for most satellite systems. The first chapters provide background on the proposed concept, OMV and ELVs. Several polar orbiting satellite systems providing mass summary breakdowns and current cost information are described and then OMV payload servicing using the flight telerobotic servicer is discussed. Comparison of estimated OMV satellite servicing costs vs. satellite replacement for several missions is tabulated. GRA

N91-27198*# National Aeronautics and Space Administration. Langley Research Center, Hampton, VA.
COMPARISON OF STRUCTURAL PERFORMANCE OF ONE- AND TWO-BAY ROTARY JOINTS FOR TRUSS APPLICATIONS
J. Douglas Vail and Mark S. Lake Washington Aug. 1991 25 p
(NASA-TM-4282; L-16904; NAS 1.15:4282) Avail: NTIS HC/MF A03 CSCL 22B

The structural performance of one- and two-bay large-diameter discrete-bearing rotary joints was addressed for application to truss-beam structures such as the Space Station Freedom. Finite element analyses are performed to determine values for rotary joint parameters that give the same bending vibration frequency as the parent truss beam. The structural masses and maximum internal loads of these joints are compared to determine their relative structural efficiency. Results indicate that no significant difference exists in the masse of one- and two-bay rotary joints. This conclusion is reinforced with closed-form calculations of rotary joint structural efficiency in extension. Also, transition truss-member loads are higher in the one-bay rotary joint. However, because of the increased buckling strength of these members, the external load-carrying capability of the one-bay concept is higher than that of the two-bay concept. Author

N91-27199* National Aeronautics and Space Administration. Langley Research Center, Hampton, VA.
SYNCHRONOUSLY DEPLOYABLE DOUBLE FOLD BEAM AND PLANAR TRUSS STRUCTURE Patent
Marvin D. Rhodes, inventor (to NASA) and John M. Hedgepeth, inventor (to NASA) (Astro Research Corp., Carpinteria, CA.) 21 May 1991 14 p Filed 22 Aug. 1986
(NASA-Case-LAR-13490-1; US-Patent-5,016,418;
US-Patent-Appl-SN-899683; US-Patent-Class-52-646;
US-Patent-Class-403-72; Int-Patent-Class-E04H-12/18) Avail: US Patent and Trademark Office CSCL 22B

A deployable structure that synchronously deploys in both length and width is disclosed which is suitable for use as a structural component for orbiting space stations or large satellites. The structure is designed with maximum packing efficiency so that large structures may be collapsed and transported in the cargo bay of the Space Shuttle. The synchronous deployment feature allows the structure to be easily deployed in space by two astronauts, without a complex deployment mechanism. The structure is made up of interconnected structural units, each generally in the shape of a parallelepiped. The structural units are constructed of structural members connected with hinged and fixed connections at connection nodes in each corner of the parallelepiped. Diagonal members along each face of the parallelepiped provide structural rigidity and are equipped with mid-length, self-locking hinges to allow the structure to collapse. The structure is designed so that all hinged connections may be made with simple clevis-type hinges requiring only a single degree of freedom, and each hinge pin is located along the centerline of its structural member for increased strength and stiffness.
Official Gazette of the U.S. Patent and Trademark Office

N91-27200* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, AL.
STANDARD REMOTE MANIPULATOR SYSTEM DOCKING TARGET AUGMENTATION FOR AUTOMATED DOCKING Patent
Richard W. Dabney, inventor (to NASA), Richard T. Howard, inventor (to NASA), and Thomas C. Bryan, inventor (to NASA) 4 Jun. 1991 12 p Filed 20 Feb. 1990
(NASA-Case-MFS-28419-1; US-Patent-5,020,876;
US-Patent-Appl-SN-431538; US-Patent-Class-350-102;
US-Patent-Class-350-97; US-Patent-Class-350-107;
Int-Patent-Class-G02B-5/122) Avail: US Patent and Trademark Office CSCL 22B

A docking target is provided for use in automated docking of a first vehicle on which the target is located. The target comprises a pair of laterally extending arm portions lying in substantially the same plane and a central post extending outwardly from the plane of the arm portions. At least three reflectors are located on the target. Two of the reflectors are located at the outboard ends of the arms portions and another reflector is located at the end of the central post. In an important embodiment, the reflectors comprise individual pieces of retroreflective tape. The reflectors, when viewed from the front of the target, are aligned along the longitudinal center line of the target, and can take a number of different shapes including circular or square.
Official Gazette of the U.S. Patent and Trademark Office

N91-27201* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, MD.
NANO-G RESEARCH LABORATORY FOR A SPACECRAFT Patent
Friedrich O. vonBun, inventor (to NASA) and Owen K. Garriott, inventor (to NASA) 4 Jun. 1991 7 p Filed 28 Apr. 1989
(NASA-Case-GSC-13197-1; US-Patent-5,020,743;
US-Patent-Appl-SN-344872; US-Patent-Class-244-159;
Int-Patent-Class-B64G-1/42) Avail: US Patent and Trademark Office CSCL 22B

An acceleration free research laboratory is provided that is confined within a satellite but free of any physical engagement with the walls of the satellite, wherein the laboratory has adequate power, heating, cooling, and communications services to conduct basic research and development. An inner part containing the laboratory is positioned at the center-of-mass of a satellite within the satellite's outer shell. The satellite is then positioned such that its main axes are in a position parallel to its flight velocity vector or in the direction of the residual acceleration vector. When the satellite is in its desired orbit, the inner part is set free so as to follow that orbit without contacting the inside walls of the outer shell. Sensing means detect the position of the inner part with respect to the outer shell, and activate control rockets to move the outer shell; thereby, the inner part is repositioned such that it is correctly positioned at the center-of-mass of the satellite. As a consequence, all disturbing forces, such as drag forces, act on the outer shell, and the inner part containing the laboratory is shielded and is affected only by gravitational forces. Power is supplied to the inner part and to the laboratory by a balanced microwave/laser link which creates the kind of environment necessary for basic research to study critical phenomena such as the Lambda transition in helium and crystal growth, and to perform special metals and alloys research, etc.
Official Gazette of the U.S. Patent and Trademark Office

19 SPACECRAFT INSTRUMENTATION

For related information see also *06 Aircraft Instrumentation* and *35 Instrumentation and Photography.*

No abstracts in this category.

20 SPACECRAFT PROPULSION AND POWER

Includes main propulsion systems and components, e.g., rocket engines; and spacecraft auxilliary power sources.

For related information see also *07 Aircraft Propulsion and Power, 28 Propellants and Fuels, 44 Energy Production and Conversion,* and *15 Launch Vehicles and Space Vehicles.*

N91-27202# Royal Aircraft Establishment, Farnborough (England).
ION ENGINE DEVELOPMENT AT THE ROYAL AIRCRAFT ESTABLISHMENT, FARNBOROUGH
B. P. Day, D. G. Fearn, and G. E. Burton May 1971 34 p

Previously announced in IAA as A71-41508
(RAE-TR-71102; RAE-Space-367; BR26144; ETN-90-90941)
Copyright Avail: NTIS HC/MF A03

A description is given of the work at the RAE devoted to the development of a 10 mN mercury electron bombardment thruster system. The present thruster has a discharge loss of 280 eV/ion and is capable of producing a focussed ion beam at an exhaust velocity of less than 30 km/s, operating with efficient vaporizers and hollow cathode. Some progress was made with flight type power supplies, a breadboard beam power supply having been built and tested, which, together with its control electronics, has an efficiency of 95 pct. Author

N91-27203*# Thiokol Corp., Brigham City, UT. Space Operations.
FOLLOW-ON CABLE COUPLING LIGHTNING TEST. VOLUME 3: APPENDIXES E AND F Final Report
31 Oct. 1990 117 p
(Contract NAS8-30490)
(NASA-CR-184125; NAS 1.26:184125; TWR-60187-Vol-3; Publ-91230) Avail: NTIS HC/MF A06 CSCL 21H

The following subject areas are covered: (1) Follow-on cable coupling lightning test swept continuous wave data plots, and (2) USBI cable coupling responses, EMA final test report (Lightning test results for the modified systems tunnel bonding on the Space Shuttle Solid Rocket Booster: tabulation of cable responses to threat level lightning testing; demonstration of linear extrapolation of swept continuous wave testing to NASA lightning specification). Author

N91-27204*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, OH.
CONCENTRATOR TESTING USING PROJECTED IMAGES
Kent S. Jefferies 1991 16 p Presented at the 26th Intersociety Energy Conversion Engineering Conference, Boston, MA, 4-9 Aug. 1991; sponsored by ANS, AIChE, SAE, ACS, AIAA, ASME, and IEEE
(NASA-TM-104349; E-6129; NAS 1.15:104349) Avail: NTIS HC/MF A03 CSCL 10B

The projected image system can be used to evaluate concentrator optical properties by comparing images reflected onto the ceiling of the test facility to theoretical facet outlines. This system was tested by comparing ceiling images to facet outlines computed using facet characteristics measured by the digital image radiometer (DIR) optical measuring system. The agreement was good, confirming the accuracy of both optical systems. Six facets were mounted in the centers of the pie sectors of one hexagonal panel. Differences between the facets and facet nonsymmetries were observed in photographs of the ceiling images of these facets. Author

N91-27205*# Pratt and Whitney Aircraft, West Palm Beach, FL. Government Engines and Space Propulsion.
ADVANCED EXPANDER TEST BED PROGRAM. PRELIMINARY DESIGN REVIEW REPORT, 27 APRIL 1990 - 31 JANUARY 1991
A. I. Masters and J. C. Mitchell May 1991 303 p
(Contract NAS3-25960)
(NASA-CR-187081; FR-21329; NAS 1.26:187081) Avail: NTIS HC/MF A14 CSCL 10B

The Advanced Expander Test Bed (AETB) is a key element in NASA's Space Chemical Engine Technology Program for development and demonstration of expander cycle oxygen/hydrogen engine technology and component technology for the next space engine. The AETB will be used to validate the high-pressure expander cycle concept, investigate system interactions, and conduct investigations of advanced mission focused components and new health monitoring techniques. The split-expander cycle AETB will operate at combustion chamber pressures up to 1200 psia with propellant flow rates equivalent to 20,000 lbf vacuum thrust. The focus was on: (1) definition of the key methodologies to be applied to the test bed design and to be verified as part of the AETB program; (2) development of transient and steady state AETB models; and (3) preparation of the AETB preliminary design of major components and systems. Author

N91-27206*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, OH.
AN EMTP SYSTEM LEVEL MODEL OF THE PMAD DC TEST BED
Narayan V. Dravid, Thomas J. Kacpura, and Kwa-Sur Tam (Virginia Polytechnic Inst. and State Univ., Blacksburg.) 1991 9 p Presented at the 26th Intersociety Energy Conversion Engineering Conference, Boston, MA, 4-9 Aug. 1991; sponsored by ANS, SAE, ACS, AIAA, ASME, IEEE, and AIChE
(NASA-TM-104515; E-6384; NAS 1.15:104515) Avail: NTIS HC/MF A02 CSCL 10B

A power management and distribution direct current (PMAD DC) test bed was set up at the NASA Lewis Research Center to investigate Space Station Freedom Electric Power Systems issues. Efficiency of test bed operation significantly improves with a computer simulation model of the test bed as an adjunct tool of investigation. Such a model is developed using the Electromagnetic Transients Program (EMTP) and is available to the test bed developers and experimenters. The computer model is assembled on a modular basis. Device models of different types can be incorporated into the system model with only a few lines of code. A library of the various model types is created for this purpose. Simulation results and corresponding test bed results are presented to demonstrate model validity. Author

N91-27207*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, OH.
THE DEVELOPMENT OF TEST BEDS TO SUPPORT THE DEFINITION AND EVOLUTION OF THE SPACE STATION FREEDOM POWER SYSTEM
James F. Soeder, Robert J. Frye, and Rudy L. Phillips (Rockwell International Corp., Canoga Park, CA.) 1991 9 p Presented at the 26th Intersociety Energy Conversion Engineering Conference, Boston, MA, 4-9 Aug. 1991; sponsored by ANS, SAE, ACS, AIAA, ASME, IEEE, and AIChE
(NASA-TM-104504; E-6365; NAS 1.15:104504) Avail: NTIS HC/MF A02 CSCL 10B

Since the beginning of the Space Station Freedom Program (SSFP), the Lewis Research Center (LeRC) and the Rocketdyne Division of Rockwell International have had extensive efforts underway to develop test beds to support the definition of the detailed electrical power system design. Because of the extensive redirections that have taken place in the Space Station Freedom Program in the past several years, the test bed effort was forced to accommodate a large number of changes. A short history of these program changes and their impact on the LeRC test beds is presented to understand how the current test bed configuration has evolved. The current test objectives and the development approach for the current DC Test Bed are discussed. A description of the test bed configuration, along with its power and controller hardware and its software components, is presented. Next, the uses of the test bed during the mature design and verification phase of SSFP are examined. Finally, the uses of the test bed in operation and evolution of the SSF are addressed. Author

N91-27208*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, OH.
UPDATE ON RESULTS OF SPRE TESTING AT NASA LEWIS
James E. Cairelli, Diane M. Swec, Wayne A. Wong, Thomas J. Doeberling, and Frank J. Madi (Sverdrup Technology, Inc., Brook Park, OH.) 1991 8 p Presented at the 26th Intersociety Energy Conversion Engineering Conference, Boston, MA, 4-9 Aug. 1991; sponsored by ANS, SAE, ACS, AIAA, ASME, IEEE, and AIChE
(NASA-TM-104425; E-6258; NAS 1.15:104425) Avail: NTIS HC/MF A02 CSCL 10B

The Space Power Research Engine (SPRE), a free-piston Stirling engine with a linear alternator, is being tested at NASA Lewis Research Center as part of the Civilian Space Technology

Initiative (CSTI) as a candidate for high capacity space power. Results are presented from recent SPRE tests designed to investigated the effects of variation in the displacer seal clearance and piston centering port area on engine performance and dynamics. The impact of these variations on PV power and efficiency are presented. Comparisons of the displacer seal clearance tests results with HFAST code predictions show good agreement for PV power, but show poor agreement for PV efficiency. Correlations are presented relating the piston midstroke position to the dynamic Delta P across the piston and the centering port area. Test results indicate that a modest improvement in PV power and efficiency may be realized with a reduction in piston centering port area. Author

N91-27209*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, OH.

GROUND TEST PROGRAM FOR A FULL-SIZE SOLAR DYNAMIC HEAT RECEIVER

L. M. Sedgwick, K. J. Kaufmann (Boeing Aerospace and Electronics Co., Seattle, WA.), K. L. McLallin, and T. W. Kerslake 1991 8 p Presented at the 26th Intersociety Energy Conversion Engineering Conference, Boston, MA, 4-9 Aug. 1991; sponsored by ANS, SAE, ACS, AIAA, ASME, IEEE, and AIChE

(NASA-TM-104485; E-6331; NAS 1.15:104485) Avail: NTIS HC/MF A02 CSCL 10A

Test hardware, facilities, and procedures were developed to conduct ground testing of a full size, solar dynamic heat receiver in a partially simulated, low Earth orbit environment. The heat receiver was designed to supply 102 kW of thermal energy to a helium and xenon gas mixture continuously over a 94 minute orbit, including up to 36 minutes of eclipse. The purpose of the test program was to quantify the receiver thermodynamic performance, its operating temperatures, and thermal response to changes in environmental and power module interface boundary conditions. The heat receiver was tested in a vacuum chamber using liquid nitrogen cold shrouds and an aperture cold plate. Special test equipment were designed to provide the required ranges in interface boundary conditions that typify those expected or required for operation as part of the solar dynamic power module on the Space Station Freedom. The support hardware includes an infrared quartz lamp heater with 30 independently controllable zones and a closed Brayton cycle engine simulator to circulate and condition the helium xenon gas mixture. The test article, test support hardware, facilities, and instrumentation developed to conduct the ground test program are all described. Author

N91-27210*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.

PHOTOVOLTAIC ARRAY SPACE POWER PLUS DIAGNOSTICS EXPERIMENT Final Report, May 1985 - Oct. 1990

D. R. Burger Nov. 1990 300 p

(Contract NAS7-918; AF Proj. 2822)

(NASA-CR-188672; NAS 1.26:188672; AD-A235585; PL-TR-91-2002) Avail: NTIS HC/MF A13 CSCL 10/2

The objective is to summarize the five years of hardware development and fabrication represented by the Photovoltaic Array Space Power Plus Diagnostics (PASP Plus) Instrument. The original PASP Experiment requirements and background is presented along with the modifications which were requested to transform the PASP Experiment into the PASP Plus Instrument. The PASP Plus hardware and software is described. Test results for components and subsystems are given as well as final system tests. Also included are appendices which describe the major subsystems and present supporting documentation such as block diagrams, schematics, circuit board artwork, drawings, test procedures and test reports. GRA

N91-27211*# Sverdrup Technology, Inc., Brook Park, OH.

TECHNOLOGY DEVELOPMENT OF FABRICATION TECHNIQUES FOR ADVANCED SOLAR DYNAMIC CONCENTRATORS Final Report

Scott W. Richter Jul. 1991 9 p Presented at the 26th Intersociety Energy Conversion Engineering Conference, Boston MA, 4-9 Aug. 1991; cosponsored by ANS, SAE, ACS, AIAA, ASME, IEEE, and AIChE

(Contract NAS3-25266)

(NASA-CR-187156; E-6380; NAS 1.26:187156) Avail: NTIS HC/MF A02 CSCL 10B

The objective of the advanced concentrator program is to develop the technology that will lead to lightweight, highly reflective, accurate, scaleable, and long lived space solar dynamic concentrators. The advanced concentrator program encompasses new and innovative concepts, fabrication techniques, materials selection, and simulated space environmental testing. Fabrication techniques include methods of fabricating the substrates and coating substrate surfaces to produce high quality optical surfaces, acceptable for further coating with vapor deposited optical films. The selected materials to obtain a high quality optical surface include microsheet glass and Eccocoat EP-3 epoxy, with DC-93-500 selected as a candidate silicone adhesive and levelizing layer. The following procedures are defined: cutting, cleaning, forming, and bonding microsheet glass. Procedures are also defined for surface cleaning, and EP-3 epoxy application. The results and analyses from atomic oxygen and thermal cycling tests are used to determine the effects of orbital conditions in a space environment. Author

N91-27212*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, OH.

EVOLVING THE SP-100 REACTOR IN ORDER TO BOOST LARGE PAYLOADS TO GEO AND TO LOW LUNAR ORBIT VIA NUCLEAR-ELECTRIC PROPULSION

Robert E. English 1991 14 p Proposed for presentation at the Conference on Advanced Space Exploration Initiative Technologies, Cleveland, OH, 4-6 Sep. 1991; cosponsored by AIAA and OAI

(NASA-TM-104527; E-6401; NAS 1.15:104527; AIAA-91-3562) Avail: NTIS HC/MF A03 CSCL 18N

In striving to reduce exploration cost and exploration risks, a crucial aspect of the plans is program continuity, i.e., the continuing application of a given technology over a long period so that experience will accumulate from extended testing here on Earth and from a diversity of applications in space. An integrated view needs to be formed of the missions SEI will carry out, near term as well as far, and of the ways in which these missions can mutually support one another. Near term programs should be so constituted as to provide for the long term missions both the enabling technologies and the accumulation of experience they need. In achieving this, missions in Earth orbit should both evolve and show the technologies crucial to long term missions on the lunar surface, and the program for the lunar labs should evolve and show the enabling technologies for exploration of the surface of Mars and for flights of human beings to Mars and return. In the near term, the program for the Space Station should be directed and funded to develop and demonstrate the solar Brayton power plant that will be most useful as the power generator for the SP-100 nuclear reactor. Author

N91-27213*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, OH.

DESIGN CONSIDERATIONS FOR SPACE RADIATORS BASED ON THE LIQUID SHEET (LSR) CONCEPT

Albert J. Juhasz and Donald L. Chubb 1991 8 p Presented at the 26th Intersociety Energy Conversion Engineering Conference, Boston, MA, 4-9 Aug. 1991; sponsored by ANS, SAE, ACS, AIAA, ASME, IEEE, and AIChE

(NASA-TM-105158; E-6446; NAS 1.15:105158) Avail: NTIS HC/MF A02 CSCL 10B

Concept development work on space heat rejection subsystems tailored to the requirements of various space power conversion systems is proceeding over a broad front of technologies at NASA LeRC. Included are orbital and planetary surface based radiator concepts utilizing pumped loops, a variety of heat pipe radiator concepts, and the innovative liquid sheet radiator (LSR). The basic feasibility of the LSR concept was investigated in prior work which generated preliminary information indicating the suitability of the

LSR concept for space power systems requiring cycle reject heat to be radiated to the space sink at low-to-mid temperatures (300 to 400 K), with silicon oils used for the radiator working fluid. This study is directed at performing a comparative examination of LSR characteristics as they affect the basic design of low earth orbit solar dynamic power conversion systems. The power systems considered were based on the closed Brayton (CBC) and the Free Piston Stirling (FPS) cycles, each with a power output of 2 kWe and using previously tested silicone oil (Dow-Corning Me2) as the radiator working fluid. Conclusions indicate that, due to its ability for direct cold end cooling, an LSR based heat rejection subsystem is far more compatible with a Stirling space power system than with a CBC, which requires LSR coupling by means of an intermediate gas/liquid heat exchanger and adjustment of cycle operating conditions. Author

N91-27214*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, OH.
SOLAR DYNAMIC POWER FOR EARTH ORBITAL AND LUNAR APPLICATIONS
James E. Calogeras, Miles O. Dustin, and Richard R. Secunde 1991 12 p Presented at the 26th Intersociety Energy Conversion Engineering Conference, Boston, MA, 4-9 Aug. 1991; sponsored by ANS, SAE, ACS, AIAA, ASME, IEEE, and AIChE
(NASA-TM-104511; E-6379; NAS 1.15:104511) Avail: NTIS HC/MF A03 CSCL 10B

Development of solar dynamic (SD) technologies for space over the past 25 years by NASA Lewis Research Center brought SD power to the point where it was selected in the design phase of Space Station Freedom Program as the power source for evolutionary growth. More recent studies showed that large cost savings are possible in establishing manufacturing processes at a Lunar Base if SD is considered as a power source. Technology efforts over the past 5 years have made possible lighter, more durable, SD components for these applications. A review of these efforts and respective benefits is presented. Author

N91-27215*# Stuttgart Univ. (Germany, F.R.). Inst. fuer Raumfahrsysteme.
NONEQUILIBRIUM IN A LOW POWER ARCJET NOZZLE Final Report
Dieter M. Zube and Roger M. Myers (Sverdrup Technology, Inc., Brook Park, OH.) Jul. 1991 24 p Presented at the 27th Joint Propulsion Conference, Sacramento, CA, 24-27 Jun. 1991; sponsored in part by AIAA, SAE, ASME and ASEE
(Contract NAS3-25266)
(NASA-CR-187166; E-6427; NAS 1.26:187166; AIAA-91-2113)
Avail: NTIS HC/MF A03 CSCL 21H

Emission spectroscopy measurements were made of the plasma flow inside the nozzle of a 1 kW class arcjet thruster. The thruster propellant was a hydrogen-nitrogen mixture used to simulate fully decomposed hydrazine. The 0.25 mm diameter holes were drilled into the diverging section of the tungsten thruster nozzle to provide optical access to the internal flow. Atomic electron excitation, vibrational, and rotational temperatures were determined for the expanding plasma using relative line intensity techniques. The atomic excitation temperatures decreased from 18,000K at a location 3 mm downstream of the constrictor to 9,000K at a location 9 mm from the constrictor, while the molecular vibrational and rotational temperatures decreased from 6,500K to 2,500K and from 8,000K to 3,000K, respectively, between the same locations. The electron density measured using hydrogen H line Stark broadening decreased from about 10(exp 15) cm(-3) to about 2 times 10(exp 14) cm(-3) during the expansion. The results show that the plasma is highly nonequilibrium throughout the nozzle, with most relaxation times equal or exceeding the particle residence time. Author

N91-27216*# Analytical Engineering Corp., North Olmsted, OH.
AN HISTORICAL PERSPECTIVE OF THE NERVA NUCLEAR ROCKET ENGINE TECHNOLOGY PROGRAM Final Report
W. H. Robbins and H. B. Finger (Sverdrup Technology, Inc., Brook Park, OH.) Jul. 1991 14 p Prepared for presentation at the Conference on Advanced Space Exploration Initiative Technologies, Cleveland, OH, 4-6 Sep. 1991; sponsored in part by NASA, AIAA, and OAI
(Contract NAS3-25266)
(NASA-CR-187154; NAS 1.26:187154; AIAA-91-3451) Avail: NTIS HC/MF A03 CSCL 21H

Nuclear rocket research and development was initiated in the United States in 1955 and is still being pursued to a limited extent. The major technology emphasis occurred in the decade of the 1960s and was primarily associated with the Rover/NERVA Program where the technology for a nuclear rocket engine system for space application was developed and demonstrated. The NERVA (Nuclear Engine for Rocket Vehicle Application) technology developed twenty years ago provides a comprehensive and viable propulsion technology base that can be applied and will prove to be valuable for application to the NASA Space Exploration Initiative (SEI). This paper, which is historical in scope, provides an overview of the conduct of the NERVA Engine Program, its organization and management, development philosophy, the engine configuration, and significant accomplishments. Author

N91-27217*# Sverdrup Technology, Inc., Brook Park, OH.
APPLIED-FIELD MPD THRUSTER GEOMETRY EFFECTS Final Report
Roger M. Myers Aug. 1991 36 p Presented at the 27th Joint Propulsion Conference, Sacramento, CA, 24-27 Jun. 1991; sponsored by AIAA, SAE, ASME, and ASEE
(Contract NAS3-25266)
(NASA-CR-187163; E-6425; NAS 1.26:187163; AIAA-91-2342)
Avail: NTIS HC/MF A03 CSCL 21H

Eight MPD thruster configurations were used to study the effects of applied field strength, propellant, and facility pressure on thruster performance. Vacuum facility background pressures higher than approx. 0.12 Pa were found to greatly influence thruster performance and electrode power deposition. Thrust efficiency and specific impulse increased monotonically with increasing applied field strength. Both cathode and anode radii fundamentally influenced the efficiency specific impulse relationship, while their lengths influence only the magnitude of the applied magnetic field required to reach a given performance level. At a given specific impulse, large electrode radii result in lower efficiencies for the operating conditions studied. For all test conditions, anode power deposition was the largest efficiency loss, and represented between 50 and 80 pct. of the input power. The fraction of the input power deposited into the anode decreased with increasing applied field and anode radii. The highest performance measured, 20 pct. efficiency at 3700 seconds specific impulse, was obtained using hydrogen propellant. Author

N91-28107*# Tuskegee Inst., AL. School of Engineering and Architecture.
ELECTRODE EROSION IN LOW POWER ARCJET THRUSTERS
A. Ghosh and Pradosh K. Ray *In* Alabama A & M Univ., NASA-HBCU Space Science and Engineering Research Forum Proceedings 1989 p 323-32 (For primary document see N91-28063 19-99)
(Grant NAG3-726)
Avail: NTIS HC/MF A23 CSCL 21H

23 CHEMISTRY AND MATERIALS (GENERAL)

N91-27218# Massachusetts Inst. of Tech., Cambridge. Dept. of Chemistry.
REDUCTION OF C BONDS PROCEEDS WITH RETENTION OF CONFIGURATION: STEREOCHEMICAL INVESTIGATION OF THE HETEROGENEOUS REDUCTION BY DIDEUTERIUM OF (HOMOHYPOSTROPHENE) NEOPENTYL (2-NORBORNYL) PLATINUM (II) COMPLEXES ON PLATINUM BLACK
T. R. Lee, Derk A. Wierda, and George M. Whitesides 23 Apr.

1991 108 p
(Contract N00014-88-K-0731)
(AD-A235515; TR-5) Avail: NTIS HC/MF A06 CSCL 07/3

An investigation is reported of the heterogeneous, platinum (0)-catalyzed reductions by dideuterium of (homohypostrophene) neopentyl (exo-2-norbornyl) platinum(II) and (homohypostrophene) neopentyl (endo-2-norbornyl) platinum (II). The stereochemistries of bonding of the norbornyl groups to platinum are rigorously defined by crystal structures. The reductions occur on the surface of the catalyst: the organic ligands are converted to alkanes via reaction of surface alkyls with surface deuterides (D); the platinum atom in the organometallic complex is reduced to platinum(0), and becomes part of the surface of the catalyst. Reduction incorporates deuterium into the exo-2 position of norbornane; analogous reduction of 2 incorporates deuterium predominantly into the endo-2 position of norbornane. These results provide the most direct evidence now available that the stereochemistry of the reduction of C bonds by H (D) proceeds with retention of configuration. GRA

N91-27219# Cornell Univ., Ithaca, NY.
PHOTOGENERATED AMINES AND DIAMINES: NOVEL CURING SYSTEMS FOR THIN FILM COATINGS
Jean M. Frechet and James F. Cameron 1 May 1991 4 p
(Contract N00014-91-J-1338)
(AD-A235568; TR-1) Avail: NTIS HC/MF A01 CSCL 07/3

The photogeneration of organic amines from alpha-dimethyl-3,5- dimethoxybenzyl carbamates is described. The photoactive carbamates are prepared easily through reactions involving the Li catalyzed addition of isocyanates to alpha-dimethyl-3,5- dimethoxybenyl alcohol or through the use of active ester chemistry. A variety of active carbamates that can be used to generate primary and secondary amines as well as diamines have been tested successfully. Free amines are liberated upon exposure of the carbamates to UV radiation below 300 nm. Preliminary tests indicate that photoactive carbamates incorporating o-nitrobenzyl groups are also readily obtainable from isocyanates. GRA

N91-27220* National Aeronautics and Space Administration. Langley Research Center, Hampton, VA.
LOW DIELECTRIC FLUORINATED POLY(PHENYLENE ETHER KETONE) FILM AND COATING Patent
Patrick E. Cassidy, inventor (to NASA), Gordon L. Tullos, inventor (to NASA), and Anne K. St.Clair, inventor (to NASA) 20 Feb. 1990 16 p Filed 23 Sep. 1988
(NASA-Case-LAR-13992-1-CU; US-Patent-4,902,769; US-Patent-Appl-SN-248009; US-Patent-Class-528-125; US-Patent-Class-528-126; US-Patent-Class-528-128; US-Patent-Class-528-219; US-Patent-Class-528-220; Int-Patent-Class-C08G-8/02; Int-Patent-Class-C08G-14/00)
Avail: US Patent and Trademark Office CSCL 07A

The present invention relates to film and coating materials prepared from novel fluorinated poly(phenylene ether ketones). A fluorinated poly(phenylene ether ketone) is prepared by reacting a bisphenol with 1,1,1,3,3,3 hexafluoro-2,2-bis 4-(4-halobenzoyl) phenyl propane (wherein halo is fluoro or chloro), which is a novel monomer formed as the reaction product of halobenzene (wherein halo is fluoro or chloro) and 1,1,1,3,3,3 hexafluoro-2,2-bis (p-chloro formyl phenyl) propane. Especially beneficial results of this invention are that films and coating materials prepared from the novel fluorinated poly(phenylene ether ketone) are essentially optically transparent/colorless and have a lower dielectric constant than otherwise comparable, commercially available poly(phenylene ether ketones). Moreover, unlike the otherwise comparable commercially available materials, the novel fluorinated poly(phenylene ether ketones) of the present invention can be solution cast or sprayed to produce the films and coatings. Furthermore, the long term thermal stability of the polymers of the present invention is superior to that of the commercially available materials.
Official Gazette of the U.S. Patent and Trademark Office

N91-27221*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, OH.
SLIDING WEAR OF SELF-MATED Al2O3-SiC WHISKER REINFORCED COMPOSITES AT 23-1200 C
Serene C. Farmer, Patricia O. Book (Cleveland State Univ., OH.), and Christopher DellaCorte Jul. 1991 29 p
(NASA-TM-104490; E-6344; NAS 1.15:104490) Avail: NTIS HC/MF A03 CSCL 07A

Microstructural changes occurring during sliding wear of self-mated Al2O3-SiC whisker reinforced composites were studied using optical, scanning electron microscopy, and transmission electron microscopy. Pin-on-disk specimens were slid in air at 2.7 m/sec sliding velocity under a 26.5 N load for 1 hr. Wear tests were conducted at 23, 600, 800, and 1200 C. Mild wear with a wear factor of 2.4 times 10(exp -7) to 1.5 times 10(exp -6) cu mm/Nm was experienced at all test temperatures. The composite shows evidence of wear by fatigue mechanisms at 800 C and below. Tribochemical reaction (SiC oxidation and reaction of SiO2 and Al2O3) leads to intergranular failure at 1200 C. Distinct microstructural differences existing at each test temperature are reported. Author

24 COMPOSITE MATERIALS

Includes physical, chemical, and mechanical properties of laminates and other composite materials.
For ceramic materials see *27 Nonmetallic Materials.*

N91-27222# Oak Ridge National Lab., TN.
THE EFFECTS OF NEUTRON IRRADIATION ON THE STRUCTURE OF CARBON-CARBON COMPOSITES
T. D. Burchell, W. P. Eatherly, G. W. Hollenberg, O. D. Slagle, and R. D. Watson (Sandia National Labs., Albuquerque, NM.) 1991 2 p Presented at the 20th Biennal Conference on Carbon, Santa Barbara, 23-28 Jul. 1991
(Contract DE-AC05-84OR-21400)
(DE91-010135; CONF-910793-1) Avail: NTIS HC/MF A01

In this paper irradiation behavior of carbon fibers and carbon-carbon composites are discussed in terms on simple microstructural models. Previous data are discussed in terms of these models. New data are presented for the irradiation-induced dimensional changes of selected carbon-carbon composites. The influence of fiber precursor on carbon-carbon irradiation performance is discussed. DOE

N91-27223*# Washington Univ., Saint Louis, MO. Center for Computational Mechanics.
HIERARCHIC MODELS FOR LAMINATED PLATES Interim Report
Barna A. Szabo and Ricardo L. Actis 24 Jul. 1991 18 p
(Grant NAG1-639)
(NASA-CR-188638; NAS 1.26:188638) Avail: NTIS HC/MF A03 CSCL 11D

The research conducted in the formulation of hierarchic models for laminated plates is described. The work is an extension of the work done for laminated strips. The use of a single parameter, beta, is investigated that represents the degree to which the equilibrium equations of three dimensional elasticity are satisfied. The powers of beta identify members in the hierarchic sequence. Numerical examples that were analyzed with the proposed sequence of models are included. The results obtained for square plates with uniform loading and homogeneous boundary conditions are very encouraging. Several cross-ply and angle-ply laminates were evaluated and the results compared with those of the fully three dimensional model, computed using MSC/PROBE, and with previously reported work on laminated strips. Author

N91-27224*# Cleveland State Univ., OH. Dept. of Chemical Engineering.
CREEP AND FRACTURE OF DISPERSION-STRENGTHENED MATERIALS Final Report
Sai V. Raj Jun. 1991 96 p Submitted for publication

(Contract NCC3-72)
(NASA-CR-185299; E-3612; NAS 1.26:185299) Avail: NTIS HC/MF A05 CSCL 11D

The creep and fracture of dispersion strengthened materials is reviewed. A compilation of creep data on several alloys showed that the reported values of the stress exponent for creep varied between 3.5 and 100. The activation energy for creep exceeded that for lattice self diffusion in the matrix in the case of some materials and a threshold stress behavior was generally reported in these instances. The threshold stress is shown to be dependent on the interparticle spacing and it is significantly affected by the initial microstructure. The effect of particle size and the nature of the dispersoid on the threshold stress is not well understood at the present time. In general, most studies indicate that the microstructure after creep is similar to that before testing and very few dislocations are usually observed. It is shown that the stress acting on a dispersoid due to a rapidly moving dislocation can exceed the particle yield strength of the G sub p/1000, where G sub p is the shear modulus of the dispersoid. The case when the particle deforms is examined and it is suggested that the dislocation creep threshold stress of the alloy is equal to the yield strength of the dispersoid under these conditions. These results indicate that the possibility that the dispersoid creep threshold stress is determined by either the particle yield strength or the stress required to detach a dislocation from the dispersoid matrix interface. The conditions under which the threshold stress is influenced by one or the other mechanism are discussed and it is shown that the particle yield strength is important until the extent of dislocation core relaxation at the dispersoid matrix interface exceeds about 25 pct. depending on the nature of the particle matrix combination. Finally, the effect of grain boundaries and grain morphology on the creep and fracture behavior of dispersoid strengthened alloys is examined. Author

N91-27225# Lawrence Livermore National Lab., CA.
A THREE-DIMENSIONAL CONSTITUTIVE THEORY FOR FIBER COMPOSITE LAMINATED MEDIA Final Report, Mar. 1988 - May 1989
Richard M. Christensen and Edward Zywicz Apr. 1991 35 p
(Contract W-7405-eng-48)
(AD-A235541; BRL-CR-662) Avail: NTIS HC/MF A03 CSCL 11/4

A three-dimensional elastic constitutive theory is developed for application to fiber composite laminated media. The lamina level constitutive relationship is a specific subset of general transversely isotropic media behavior. This special class of lamina behavior permits the development of an exact lamination procedure for systems assembled from a single lamina type. The three-dimensional constitutive form for the laminate is determined in terms of the sub-scale lamina properties and the orientations of each lamina. The extension of this specific constitutive relationship to general transversely isotropic lamina involves separation of the five lamina-scale properties into fiber-dominated vs. matrix-dominated properties. The resulting three-dimensional constitutive/lamination theory is evaluated through comparisons between exact solutions, using data bases appropriate for graphite and glass epoxy systems in quasi-isotropic lay-ups. The theory remains highly effective through the transition from thin laminate to thick laminate behavior and even beyond that through the transition from thick laminate behavior to fully and strongly three-dimensional elastic behavior. GRA

N91-27226# Dayton Univ., OH. Research Inst.
CARBON FIBER MORPHOLOGY. 2: EXPANDED WIDE-ANGLE X RAY DIFFRACTION STUDIES OF CARBON FIBERS Interim Report, Dec. 1988 - Apr. 1990
David P. Anderson Feb. 1991 110 p
(Contract F33615-87-C-5239)
(AD-A235599; WRDC-TR-90-4137) Avail: NTIS HC/MF A06 CSCL 11/2

The wide angle x ray diffraction studies and results on carbon and graphite fibers are described. Commercial PAN- and pitch-based carbon fibers spanning the generally available modulus range were examined. Crystal perfection, size, orientation, and degree of graphitization and calculated voids content are correlated with tensile modulus, tensile strength, and compression strength. These same parameters are examined as a function of heat treatment of several fibers as well. GRA

N91-27227# David Taylor Research Center, Bethesda, MD. Ship Materials Engineering Dept.
VIBRATION DAMPING RESPONSE OF COMPOSITE MATERIALS Research and Development Report
Roger M. Crane Apr. 1991 302 p
(AD-A235614; DTRC/SME-91/12) Avail: NTIS HC/MF A14 CSCL 11/4

The mechanical vibration damping characteristics of glass/epoxy and graphite/epoxy composite materials were studied. The objective was to develop an analytical model which incorporates the frequency dependence of the vibration damping loss factor and to experimentally characterize the loss factor for frequencies up to 100 Hz. Numerous mathematical models were proposed to determine the loss factor of composites, including micromechanical, macromechanical and structure models. Of these generic types, the macromechanical models incorporate important material characteristics which can affect the loss factor. The most widely accepted model utilizes the elastic viscoelastic correspondence principle. Although investigators acknowledge the viscoelasticity of composites, they fail to incorporate the frequency dependence in their analysis. In this effort, the elastic viscoelastic correspondence principle is extended to incorporate the frequency dependence of the composite material. The analytical model requires as input the inplane material loss factors as a function of frequency. Cantilever beam specimens were utilized which excited using an impulse from an instrumented force hammer. The loss factor was calculated using the half power bandwidth technique. The apparatus was calibrated using a well characterized low damping material. The effect of clamping pressure and of the clamp block to specimen interface material was also investigated. GRA

N91-27228# Colorado State Univ., Fort Collins. Dept. of Physics.
PREPARATION AND CHARACTERIZATION OF CARBON FILAMENTS Final Report, 1988 - 1991
Dinesh Patel and Carol McConica Apr. 1991 260 p
(Contract F49620-88-C-0017)
(AD-A235633; AFOSR-91-0444TR) Avail: NTIS HC/MF A12 CSCL 11/2

The final report for our contract 'Preparation and Characterization of Carbon Filaments' is presented. We have performed important and extensive research on Catalytic Chemical Vapor deposited fibers with comparative work on ex-polymer fibers. A new diagnostic technique has been developed involving low frequency electrical noise in carbon fibers. The exciting results from this technique infer microstructure properties as inter-ribbon and inter-layers are probed. Mechanical properties including Young's modulus, torsional modulus and compressive properties have been measured also on CCVD filaments. We have proved that Young's modulus of CCVD fibers generally decrease with diameter. However, increases in the Young's modulus of CCVD fibers generally decrease with diameter. However, increases in the Young's modulus for a small range of diameters may be present due to separating entities during the growth of CCVD fibers. Higher torsional moduli were also measured for these annular structures. Typical values were as high as one quarter theoretical maximum for a perfectly ordered system. Temperature dependent piezoresistance was observed for the first time in high moduli fibers. GRA

N91-27229# California Univ., Santa Barbara. Dept. of Materials.
METAL/CERAMIC INTERFACES: RELATIONSHIPS BETWEEN STRUCTURES, CHEMISTRY, AND INTERFACES Annual Report, 15 Mar. 1989 - 15 Mar. 1991

A. G. Evans 15 Mar. 1991 135 p
(Contract N00014-89-J-1764)
(AD-A235713) Avail: NTIS HC/MF A07 CSCL 11/4

Interface fracture resistance measurements have been conducted on metal/ceramic interfaces with and without reaction products. Both ductile and brittle interface fracture have been documented. Some effects of residual stress have also been investigated. The influence of thermal expansion misfit on the mechanical behavior of metal/ceramic bonded systems has been shown to be strongly governed by the sign of the misfit strain, its magnitude, the yield strength of the metal and to be subject to substantial geometric effects. In some cases, the misfit causes interface failure, while in other, cracking occurs in the ceramic. Generally, misfit has detrimental effects on bond strength, but in special cases, the bond strength can actually be improved. Reaction products exhibit a wide variety of fracture behaviors. In some cases, the reaction products are brittle and subject to residual stress, leading to low fracture energy interfaces governed by the fracture resistance of the reaction product. In other cases ductile reaction products occur, resulting in good bond properties and fracture energies that increase as the reaction product layer thickness increases. Stress corrosion has been found to occur at oxide/metal interfaces, leading to substantial reductions in the fracture resistance. The phenomenon is governed by water vapor and is similar to, but more pronounced than, that found in oxides. GRA

N91-27230# University of Southern California, Los Angeles. Hydrogen Research Inst.
COMPOSITE MATERIALS WITH IMPROVED PROPERTIES IN COMPRESSION Annual Report No. 2, 1 May 1989 - 30 Apr. 1991
William P. Weber 30 Apr. 1991 31 p
(Contract N00014-89-J-1961)
(AD-A235954) Avail: NTIS HC/MF A03 CSCL 11/4

This is a compilation of reports relating to preparation of composite materials which have high strength in compression. The scientific approach is used to prepare novel polymeric coupling agents. These will permit formation of multiple flexible covalent bonds between fibers as well as to matrix materials. In addition, these new coupling agents will possess elastomeric properties which may increase matrix toughness to fracture. GRA

N91-27231# Wright State Univ., Dayton, OH.
CHEMICAL COMPATIBILITY AND OXIDATION RESISTANCE OF POTENTIAL MATRIX AND REINFORCEMENT MATERIALS IN CERAMIC COMPOSITES FOR ULTRA-HIGH TEMPERATURE APPLICATIONS Final Report, 30 Sep. 1987 - 31 Jan. 1990
Gopal M. Mehrotra Mar. 1991 162 p Sponsored by Wright Research Development Center
(AD-A235958; WRDC-TR-90-4127) Avail: NTIS HC/MF A08 CSCL 11/2

The mutual chemical composition and compatibilities of some of the potential matrix and reinforcement phases of ceramic composite materials have been investigated in the temperature range 1600 to 2200 C. The oxidative stabilities of hot pressed, particulate composites containing 50:50 volume percent of each compound in a material combination have been studied in the temperature range 1000 to 1600 C. The material combinations investigated are: AlN-ZrB2, AlN-HfB2, MoSi2-ZrB2, MoSi2-HfB2, SiB6-ZrB2, SiB6-HfB2, TiC-HfB2, TiN-ZrO2, TiN-HfO2, SiB6-ZrOHfO2, ZrC-ZRO2, and HfC-HfO2. The objective of these studies was to identify the promising material combinations for structural applications in oxidizing environments at a high temperature range of 1600 to 2200 C. Results indicate that compounds in the systems AlN-ZrB2, AlN-HfB2, HfC-HfO2, TiN-ZrO2 and TiN-HfO2 are mutually compatible at 1600 C. The MoSi2-ZrB2 and MoSi-HfB2 composites, especially MoSI2-HfB2 appear to have the best oxidative stability in air up to 1600 C. The oxidative stability of ZrC-ZrO2 and HfC-HfO2 composites in air was found to be very poor in the temperature range 1000 to 1600 C. GRA

N91-27232# David Taylor Research Center, Bethesda, MD. Ship Materials Engineering Dept.
DAMPING STUDIES OF CERAMIC REINFORCED ALUMINUM Research and Development Report
Catherine R. Wong and Stephen Holcomb Mar. 1991 24 p
(AD-A235965; DTRC/SME-91/15) Avail: NTIS HC/MF A03 CSCL 11/4

Ceramic reinforced aluminum alloys exhibit a unique combination of mechanical properties not found in monolithic aluminum alloys. The addition of high modulus ceramic particles to conventional aluminum alloys results in increased strength, elastic modulus and wear resistance. Because of these desirable engineering properties the damping capacity and storage modulus was measured as a function of ceramic volume fraction, temperature and frequency. Two Al-Si-Mg matrix composites were studied which included the wrought alloy 6061-T6 with 0 to 0.2 volume fraction of Al2O3 particles and the casting alloy A356-T6 with 0 to 0.2 volume fraction of SiC particles. They were manufactured by a process which is simpler and less costly then previously developed techniques for manufacturing metal matrix composites. The damping capacity and storage modulus were measured at 0.1, and 10 Hz while the temperature was varied from -10 to 250 C. It was found that the cast matrix has a higher damping capacity than the wrought matrix above 100 C, possibly due to the presence of silicon in the matrix which lowers the grain boundary transition peak. The storage modulus and damping capacity increased with increasing reinforcement content. These results are consistent with other work done on ceramic reinforced aluminum alloys. GRA

N91-27233# Materials Sciences Corp., Blue Bell, PA.
COMPOSITE SPECIMEN DESIGN ANALYSIS. VOLUME 1: ANALYTICAL STUDIES Final Report, 12 Jun. 1987 - 30 Jun. 1990
S. N. Chatterjee, E. C. Wung, V. Ramnath, and C. F. Yen Jan. 1991 263 p
(Contract DAAL04-87-C-0064; DA Proj. 1L6-65502-MM-40)
(AD-A235990; MSC-TFR-2110/1705-Vol-1; MTL-TR-91-5-Vol-1)
Avail: NTIS HC/MF A12 CSCL 11/4

The anisotropic nature of fiber reinforced composites introduces considerable complexity in testing. Problems arise due to the difficulty in attaining uniform or uniaxial stress states in test specimens. A thorough understanding of the behavior of the composite is therefore essential before the test data generated from such tests can be used with confidence. Due to the limited scope of the Phase 1 effort, attention was focused in this phase only on in-plane shear test methods. A combined analytical/experimental program was conducted in Phase 2 to evaluate various test methods for tensile strength, compressive strength in-plane shear and interlaminar shear strength. Appendix A of this part contains the results of studies on compression tests. In-plane and interlaminar shear tests are discussed in Appendix B. Combined stress tests and damage analysis are presented in Appendix C. Appendix D gives the analytical studies performed on some interlaminar fracture toughness tests. GRA

N91-27234# Wright Research Development Center, Wright-Patterson AFB, OH.
LOW-VELOCITY IMPACT TESTING OF THERMOPLASTIC AND THERMOSET MATRIX COMPOSITE MATERIALS Final Report, Jan. 1985 - Jan. 1988
Margaret F. Pinnell and Peter O. Sjoblom Nov. 1990 54 p
(AD-A236092; WRDC-TR-90-4078) Avail: NTIS HC/MF A04 CSCL 11/4

The effects of boundary conditions, specimen thickness, indenter nose diameter, impact velocity and target material on the damage initiation load and mode of failure during low-velocity impact of composite materials are studied. A mathematical model is presented which theoretically predicts the effects of the various parameters on the damage initiation force. In addition, a comparison of the static indentation versus low-velocity impact results is made in an effort to prove that low-velocity impact can be sufficiently modelled using statically based theories. Experimental data

indicated that the mathematical model predicts the effect of material thickness on damage initiation force very well. Data obtained from static indentation and low-velocity impact were found to be comparable. Some differences were noted in the impact failure modes of the two materials tested. GRA

N91-27235# United Technologies Research Center, East Hartford, CT.
INTERFACIAL STUDIES OF REFRACTORY GLASS-CERAMIC MATRIX/ADVANCED SiC FIBER REINFORCED COMPOSITES Annual Report, 1 Feb. 1990 - 1 Feb. 1991
J. J. Brennan 30 Apr. 1991 62 p
(Contract F33615-89-C-5628)
(AD-A236212; UTRC/R91-918246-2) Avail: NTIS HC/MF A04 CSCL 11/2

The main objective of this program is to characterize the chemistry and structure and microstructure of new advanced small diameter SiC type fibers and how these factors influence the nature of the fiber/matrix interface in refractory glass-ceramic matrix composites. It is the nature of this interface that then determines to a great degree the composite thermal, environmental, and mechanical properties. The fibers under investigation included new experimental polymer derived crystalline SiC fibers as well as the new commercially available low oxygen 'Lox M' Tyranno SiC type fibers. It was found that the mechanical properties of Lox M Tyranno fiber/LAS (lithium aluminosilicate) and BMAS (barium-magnesium aluminosilicate) metal matrix composites were much improved over similar composite materials fabricated with older higher oxygen content Tyranno fibers. An approximately 500 A thick carbon rich fiber/matrix interfacial layer was found to form during the composite fabrication, similar to that found to comparable NICALON fiber composites except for the additional formation of titanium rich crystalline particles within or near the carbon rich layer. The thermal properties and mechanical properties of both LAS and BMAS matrix composites were very similar for either Lox M Tyranno or NICALON fiber reinforcement. GRA

N91-27236# Dayton Univ., OH. Graduate School of Engineering and Research.
EFFECTS OF DEPOLARIZATION ON THE MICROWAVE PROPERTIES OF COMPOSITES Final Report, Jul. - Dec. 1989
C. Vittoria May 1991 25 p Prepared in cooperation with Northeastern Univ., Boston, MA
(Contract F30602-88-D-0028)
(AD-A236349; RL-TR-91-50) Avail: NTIS HC/MF A03 CSCL 11/4

Mathematical relationship for the dielectric and permeability constants of single particle and composite materials are being formulated and tested in experimental conditions. For dilute concentrations of particles imbedded in binder materials, reasonable agreement is found between measured and calculated values of the constants. The theoretical formulation is based upon a two-parameter theory (magnetization and magnetic anisotropy field). Microwave properties of composite materials are of interest since it is possible to control or design the constituents of a composite in order to obtain a desirable property of the composite. In this report, we concentrate our attention on the effect of particle shape on the microwave properties of a composite. In particular, we consider metallic as well as insulating particles distributed randomly in known binders. GRA

N91-27237# Army Lab. Command, Watertown, MA. Material Technology Lab.
A COMPARISON OF VOID MEASUREMENT METHODS FOR CARBON/EPOXY COMPOSITES Final Report
Seth R. Ghiorse Apr. 1991 29 p
(AD-A236438; MTL-TR-91-13) Avail: NTIS HC/MF A03 CSCL 14/2

This report studies four destructive measurement techniques for determining void volume fraction in CFRP composites. Two approaches to void measurement were taken: density determination/matrix digestion (DD/MD), and optical image analysis. Within each approach two techniques were studied. In the DD/MD approach, the water buoyancy technique (WBY0 (see ASTM D 792) and density gradient technique (DGT) (see ASTM D 1505) were investigated. In the image analysis approach a Dapple Image Analyzer, and the more automated Omnimet Image Analyzer, techniques were investigated. It was found that true or absolute void content is quite difficult to measure regardless of the technique used. However, when making relative measurements between like specimens void content comparisons are reliable and practical to obtain. The WBT recorded consistently lower void content data than the DGT; it was also found to be less precise. For routine CFRP, void content determination, where relative comparisons are sufficient and high precision is not an issue, the WBT is recommended as it is practical to implement. When high precision is needed, the DGT is recommended. Image analysis methods produce highly localized data, but it is likely that they approximate true void content more closely than the DD/MD method because the void measurement, though actually a measure of void area, is direct. For more critical void content measurement where accuracy, as well as precision are required, a highly automated version of an image analysis te chnique, like the Omnimet, which scans the large number of cross sections is recommended. GRA

N91-27238# Case Western Reserve Univ., Cleveland, OH. Dept. of Macromolecular Science.
SURFACE INDUCED CRYSTALLIZATION IN FIBER REINFORCED SEMICRYSTALLINE THERMOPLASTICS COMPOSITES
Hatsuo Ishida and Philippe Bussi Mar. 1991 88 p
(Contract N00014-88-R-0330)
(AD-A236591; CWRU/DMS/TR-43) Avail: NTIS HC/MF A05 CSCL 20/2

This paper reviews the parameters influencing the appearance of a transcrystalline zone and the experimental techniques which have been used in the study of transcrystallization. A significant example is given for each characterization technique. The influence of transcrystallinity on the mechanical properties of the composite is then examined. Lastly, a theoretical approach based on the theory of heterogeneous nucleation and on the indication time is presented, which allows for the control of the extent of the transcrystalline morphology. Little has been published on the mechanical aspect of transcrystallinity but this is an important aspect because this will ultimately determine if it is desirable to induce transcrystallinity. This is an important aspect for this will ultimately determine if it is desirable to induce transcrystallization in semicrystalline thermoplastic composites. Although the main application of transcrystallization seems to be in fiber reinforced composites, results of studies with films as a substrate are directly applicable to fiber reinforced composites and have also been included in this chapter. GRA

N91-27239# Princeton Univ., NJ. Dept. of Civil Engineering and Operations Research.
DAMAGE MECHANICS OF COMPOSITE MATERIALS: CONSTITUTIVE MODELING AND COMPUTATIONAL ALGORITHMS Final Report, 1 Oct. 1988 - 30 Sep. 1990
Jiann-Wen Ju 21 Apr. 1991 106 p
(Grant AF-AFOSR-0020-89; AF Proj. 2302)
(AD-A236696; PU/CEOR/SM-91-4; AFOSR-91-0530TR) Avail: NTIS HC/MF A06 CSCL 11/4

The present work is concerned with development of innovative damage mechanics models for constitutive modeling of modern composite materials. Special attention is focused on micromechanical damage theories to explain and model behavior of composites based on micromechanics and micro-geometry. In particular, basic studies are performed on the notion of isotropic and anisotropic damage variables in continuum damage mechanics. Furthermore, a micromechanical damage model is presented for uniaxially reinforced composites and is analytically derived based on micromechanical bi-material arc crack solutions. Finally, a novel three-dimensional statistical micromechanical theory is proposed to investigate the nonlinear behavior of microcrack-weakened brittle solids. The theory is fundamentally different from existing effective

medium theories and deterministic microcrack interaction method. GRA

N91-27240# Materials Sciences Corp., Blue Bell, PA.
MICROMECHANICAL EVALUATION OF CERAMIC MATRIX COMPOSITES Final Report, 1 Apr. 1988 - 28 Feb. 1991
C.-F. Yen, Z. Hashin, C. Laird, B. W. Rosen, and Z. Wang Feb. 1991 107 p
(Contract F49620-88-C-0069)
(AD-A236756; MSC-TFR-2201/1506; AFOSR-91-0513TR) Avail: NTIS HC/MF A06 CSCL 11/4

Analytical and experimental studies have been performed to investigate the thermomechanical properties and failure mechanisms in unidirectional ceramic composites in which the ceramic matrix is flawed and variable. Preliminary model for brittle matrix with a periodic hexagonal array of identical fibers has been analyzed on the basis of numerical fracture mechanics to assess criticality of various kinds of cracks. When this composite model is subjected to axial load, it was found that transverse matrix cracks become unstable for perfect bonding and for disbonding between fibers and matrix, while disbond cracks propagating parallel to the fibers tend to stabilize. The Air Force goal of developing high thrust-to-weight turbine engines depends strongly upon the advancement of high temperature ceramic composites. Ceramic materials retain stiffness at very high temperatures but their extreme brittleness precludes their use as structural materials, since cracks propagate easily and catastrophically. When a ceramic matrix is reinforced with unidirectional fibers the effect of cracks changes fundamentally. GRA

N91-27241# North Carolina Agricultural and Technical State Univ., Greensboro. Dept. of Mechanical Engineering.
IMPACT DAMAGE TOLERANCE OF COMPOSITES EXPOSED TO HOT, COLD, AND WET ENVIRONMENTS Final Report, Sep. 1984 - Dec. 1990
V. S. Avva Jan. 1991 226 p
(AF Proj. 2401)
(AD-A236869; WL-TR-91-3011) Avail: NTIS HC/MF A11 CSCL 11/4

The purpose of the present study was to determine the failure threshold (with respect to energy level of impact) of Torlon-C/graphite/glass and APC-2 composite materials, with the samples being conditioned and tested at predetermined hygrothermal environments. A test matrix involving ply-orientations, temperature (-60, 75, 180, and 280 F) and humidities (15, 50, abd 100 percent RH) was created. For each test condition of the matrix, the failure threshold was developed by subjecting compression coupons to impact damage at various energy levels with a 12.7 mm diameter aluminum projectile. The forward velocities used in the tests ranged from 27.4 to 152.4 m/s (90 to 500 ft/s). The behavior of composite materials under the combined effects of impact, humidity, and temperature has been a topic of concern among investigators. Much of the research currently available has focused upon the effect of a single factor (e.g., impact), or the effect of humidity and temperature. The purpose of this study was to investigate the combined effect of all these factors on the degradation of laminates. GRA

N91-27242*# Case Western Reserve Univ., Cleveland, OH.
DEVELOPMENT OF GRAPHITE/COPPER COMPOSITES UTILIZING ENGINEERED INTERFACES M.S. Thesis Final Report
Sandra M. DeVincent Jun. 1991 107 p Sponsored in part by DARPA
(Contract NCC3-94)
(NASA-CR-187143; NAS 1.26:187143) Avail: NTIS HC/MF A06 CSCL 11D

In situ measurements of graphite/copper alloy contact angles were made using the sessile drop method. The interfacial energy values obtained from these measurements were then applied to a model for the fiber matrix interfacial debonding phenomenon found in graphite/copper composites. The formation obtained from the sessile drop tests led to the development of a copper alloy that suitably wets graphite. Characterization of graphite/copper alloy interfaces subjected to elevated temperatures was conducted using Scanning Electron Microscopy, Energy Dispersive Spectroscopy, Auger Electron Spectroscopy, and X Ray Diffraction analyses. These analyses indicated that during sessile drop tests conducted at 1130 C for 1 hour, copper alloys containing greater than 0.98 at pct chromium form continuous reaction layers of approx. 10 microns in thickness. The reaction layers are adherent to the graphite surface. The copper wets the reaction layer to form a contact angle of 60 deg or less. X ray diffraction results indicate that the reaction layer is Cr3C2. Author

N91-27243*# California Univ., Santa Barbara. Dept. of Mechanical and Environmental Engineering.
MECHANICAL BEHAVIOR OF A CONTINUOUS FIBER REINFORCED ALUMINUM MATRIX COMPOSITE SUBJECTED TO TRANSVERSE AND THERMAL LOADING Final Report
S. Jansson and F. A. Leckie Jun. 1991 33 p
(Grant NAG3-894)
(NASA-CR-187132; NAS 1.26:187132) Avail: NTIS HC/MF A03 CSCL 11D

The transverse properties of an aluminum alloy metal matrix composite reinforced by continuous alumina fibers were investigated. The composite is subjected to both mechanical and cyclic thermal loading. The results of an experimental program indicate that the shakedown concept of structural mechanics provides a means of describing the material behavior. When the loading conditions are within the shakedown region, the material finally responds in an elastic manner after initial plastic response, and for loading conditions outside the shakedown region, the material exhibits a rapid incremental plastic strain accumulation. The failure strain varies by an order of magnitude according to the operating conditions. Hence, for high mechanical and low thermal loading, the failure strains is small; for low mechanical and high thermal loading, the failure strain is large. Author

N91-27244* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, OH.
METHOD OF MAKING CARBIDE/FLUORIDE/SILVER COMPOSITES Patent
Harold E. Sliney, inventor (to NASA) and Christopher Dellacorte, inventor (to NASA) 23 Jul. 1991 10 p Filed 23 Aug. 1990
(NASA-Case-LEW-14902-1; US-Patent-5,034,187;
US-Patent-Appl-SN-571058; US-Patent-Class-419-14;
US-Patent-Class-419-30; US-Patent-Class-419-32;
US-Patent-Class-419-36; US-Patent-Class-419-38;
US-Patent-Class-419-39; US-Patent-Class-419-49) Avail: US Patent and Trademark Office CSCL 11D

A composition containing 30 to 70 percent chromium carbide, 5 to 20 percent soft noble metal, 5 to 20 percent metal fluorides, and 20 to 60 percent metal binder is used in a powdered metallurgy process for the production of self-lubricating components, such as bearings. The use of the material allows the self-lubricating bearing to maintain its low friction properties over an extended range of operating temperatures.
Official Gazette of the U.S. Patent and Trademark Office

N91-27245# National Inst. of Standards and Technology, Gaithersburg, MD. Robot Systems Div.
AMRF COMPOSITES FABRICATION WORKSTATION: A TEST METHODOLOGY TO MEASURE THE QUALITY OF THERMOPLASTIC COMPOSITE PARTS
J. A. Falco Apr. 1991 23 p
(PB91-187765; NISTIR-4552) Avail: NTIS HC/MF A03 CSCL 11D

The Robot Systems Div. of the National Institute of Standards and Technology (NIST) requires a test methodology to measure the quality of the composite parts produced by an advanced manufacturing workstation being assembled in the Automated Manufacturing Research Facility (AMRF). The workstation will be used to study methods of fabricating complex shaped, continuous carbon fiber reinforced, thermoplastic composite parts using preimpregnated tow. The mechanisms are discussed of

thermoplastic consolidation and the various defects associated with poor consolidation. Several testing techniques are discussed concerning their ability to locate, identify and/or quantify these defects. The discussion is followed by a trade off analysis of all considered testing techniques in an attempt to determine the most effective test methodology to measure the quality of thermoplastic composite parts. Author

N91-27246*# Mississippi State Univ., Mississippi State. Dept. of Chemical Engineering.
PROCEEDINGS OF THE ADVISORY COMMITTEE ON STANDARDIZATION OF CARBON-PHENOLIC TEST METHODS AND SPECIFICATIONS
William B. Hall 4 Mar. 1991 259 p Meeting held in Elizabethton, TN, 15-16 Nov. 1990
(Grant NAG8-545)
(NASA-CR-188678; NAS 1.26:188678) Avail: NTIS HC/MF A12 CSCL 11D

Proceedings of the Advisory Committee on Standardization of carbon-phenolic test methods and specifications are compiled. The following subject areas are covered: ashing procedures and alkali metal content of carbon fiber and fabrics; SPIP product identification code; SPIP initiative to adopt a water-soluble rayon yarn lubricant/size for weaving; fabric oxidation mass loss test; shelf life limit for prepregs, industry standard; silicon contamination update; resin, filler, and fabric content in prepreg; carbon assay testing calibration; thiokol rayon specifications; and SPIP low conductivity PAN program. Author

N91-27247*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, OH.
MATRIX PLASTICITY IN SiC/Ti-15-3 COMPOSITE
Bradley A. Lerch Jul. 1991 11 p
(NASA-TM-103760; E-6017; NAS 1.15:103760) Avail: NTIS HC/MF A03 CSCL 11D

An experimental method is described which allows for the observation of slip bands due to matrix plasticity in the SiC/Ti-15-3 composite system. A post-test heat treatment and subsequent chemical etch is employed to reveal slip bands in the titanium matrix. Composite specimens of various laminates were examined after tensile testing at room temperature. This method definitively shows that matrix plasticity has occurred in all the laminates investigated and at load/strain levels which were insufficient to cause fiber breakage. Author

N91-28082*# Alabama A & M Univ., Huntsville. Dept. of Chemistry.
ANALYSIS OF CURED CARBON-PHENOLIC DECOMPOSITION PRODUCTS TO INVESTIGATE THE THERMAL DECOMPOSITION OF NOZZLE MATERIALS
James M. Thompson and Janice D. Daniel *In its* NASA-HBCU Space Science and Engineering Research Forum Proceedings 1989 p 108-126 (For primary document see N91-28063 19-99)
Avail: NTIS HC/MF A23 CSCL 11D

N91-28123*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, AL.
AN EVALUATION OF THE INTERFACIAL BOND PROPERTIES BETWEEN CARBON PHENOLIC AND GLASS PHENOLIC COMPOSITES
Kelvin Jordan, Raymond Clinton, and Shaik Jeelani (Tuskegee Inst., AL.) *In* Alabama A & M Univ., NASA-HBCU Space Science and Engineering Research Forum Proceedings 1989 p 450-47 (For primary document see N91-28063 19-99)
(Grant NGT-50130)
Avail: NTIS HC/MF A23 CSCL 11D

25 INORGANIC AND PHYSICAL CHEMISTRY

Includes chemical analysis, e.g., chromatography; combustion theory; electrochemistry; and photochemistry.

For related information see also *77 Thermodynamics and Statistical Physics.*.

N91-27248# New Hampshire Univ., Durham.
A MEMBRANE FOR IN-SITU OPTICAL DETECTION OF ORGANIC NITRO COMPOUNDS BASED ON FLUORESCENCE QUENCHING
W. R. Seitz, Chen Jian, and Donald C. Sundberg Jan. 1991 15 p
(Contract DACA89-89-K-0004)
(AD-A234071; CETHA-TE-CR-91001) Avail: NTIS HC/MF A03 CSCL 19/1

In the past, unsound explosive disposal practices have led to contamination of various sites by nitrated organics. Because these compounds partition significantly into water from soils, they can migrate in ground-water posing a potential health hazard. Groundwater monitoring for several different nitrated organics is required to evaluate the extent of this problem. Hexahydro 1,3,5-trinitro 1,3,5-triazine (RDX) and 2,4,6-trinitrotoluene (TNT) are two most important because they are manufactured and used in larger quantities than other explosives. RDX is of greater concern because it is stable and migrates more rapidly in groundwater. Current practice is to get samples from monitoring wells and to bring them back to the laboratory for analysis. This is expensive and subject to potential error owing to contamination or instability of samples. As a consequence, there is a need for rapid, inexpensive screening methods that function in situ. Even if these methods do not yield definitive analytical results, they will be useful if they identify those samples that need to be brought back to the laboratory for comprehensive analysis. The goal was to develop solid phase indicators that can be used for in-situ determination of nitrated organics. GRA

N91-27249# Utah Univ., Salt Lake City. Dept. of Chemistry.
MOLECULAR TRANSPORT IN POROUS SILICA. QUENCHING OF FLUORESCENCE FROM SURFACE-IMMOBILIZED PYRENE Technical Report, Jun. 1990 - May 1991
A. L. Wong, M. L. Hunnicutt, and J. M Harris 22 Apr. 1991 13 p
(Contract N00014-89-J-1412)
(AD-A234643; TR-21-ONR) Avail: NTIS HC/MF A03 CSCL 20/6

Quenching of fluorescence from a surface immobilized probe is developed as a method for measuring molecular transport in porous silica. In these experiments, 3-(1-pyrenyl) propyidimethyl chlorosilane is covalently bonded to the surface of porous silica, and the rates of fluorescence quenching of this fluor by iodine were measured in a series of primary alcohols. Interfacial quenching rates were compared to those measured for 1-methyl pyrene in free solution in the same solvents. Differences in the measured rates of quenching at the solid-liquid interface could be attributed to the volume excluded from quencher by the solid surface. A simple hemispherical diffusion model provided reasonable predictions of the rates of quenching based on the diffusion coefficients of iodine measured in free solution. The results indicate that the viscosity of alcohols within the pores of silica does not differ significantly from bulk solution values. Author

N91-27250# Washington Univ., Seattle. Dept. of Materials Science and Engineering.
MATERIALS CHEMISTRY SYMPOSIUM, AMERICAN CHEMICAL SOCIETY NORTHWEST REGIONAL MEETING Final Report, 1 Jun. - 30 Nov. 1989
Richard M. Laine May 1990 6 p Meeting held 14-15 Jun. 1989
(Grant AF-AFOSR-0546-89; AF Proj. 2303)
(AD-A235440; AFOSR-91-0468TR) Avail: NTIS HC/MF A02 CSCL 07/4

The basic theme of materials chemistry is the synthesis and or fabrication of new materials by molecular design. The rationale focusses on the concept that molecular building blocks can be used to create materials with completely tailored mechanical, electronic, and optical properties. Materials chemistry has been used successfully on a commercial scale for the fabrication of electronic materials, new optical materials, and new structural ceramics. Because materials chemistry is in its infancy, it is likely that it will offer still greater academic and industrial rewards as the field develops, especially at the interfaces of the various domains that comprise the field. The symposium provided researchers in specific materials chemistry domains with the opportunity to obtain critical input from researches in their own fields and exposure to areas outside their specialty, thereby creating the opportunity for cross fertilization, as amplified in the following section. GRA

N91-27251# Aerospace Corp., El Segundo, CA. Lab. Operations.
RESONANT PHOTOELECTRON SPECTROSCOPY AT THE Mo 4p YIELDS 4d ABSORPTION EDGE IN MoS2
J. R. Lince, S. V. Didziulis, and J. A. Yarmoff 22 Mar. 1991 28 p
(Contracts F04701-88-C-0089; DE-AC02-76CH-00016)
(AD-A235469; TR-0090(5945-03)-4; SSD-TR-91-90) Avail: NTIS HC/MF A03 CSCL 07/2

A systematic study has been conducted of the resonant behavior of the valence band photoelectron spectrum of MoS2 for h(nu) = 26 to 70 eV, spanning the Mo 4p to 4d transition region. A broad Fano-like resonance appears at 42 eV in the constant initial state (CIS) intensity plot of the d(sub z squared) peak near the valence band maximum (2 eV binding energy(BE)), confirming its predominantly Mo 4d character. A second shoulder on the higher h(nu) side of the maximum in the d(sub z squared) CIS intensity plot is suggested to result from transitions to unoccupied states in the 5(sp) band 10 eV above EF, by comparison with a partial yield spectrum and previous inverse photoemission data. The region of the valence band in the range 3 to 4.5 eV BE also exhibits resonant behavior, indicating Mo 4d character, although somewhat less than for the d(sub z squared) peak. A feature at 30 eV in the CIS intensity plot for the 5 to 7 eV BE range could not be definitely assigned in this study, but may be due to a resonance between direct photoemission and a process involving absorption and autoionization of electronic states that contain Mo 5s and 5p character. GRA

N91-27252# State Univ. of New York, Buffalo. Dept. of Chemistry.
COMMENT ON EFFECT ON SURFACE RECONSTRUCTION ON STABILITY AND REACTIVITY OF Si CLUSTERS
Brian L. Swift, Daniel A. Jelski, Donald E. Higgs, Tapio T. Rantala, and Thomas F. George Apr. 1991 10 p
(Contract N00014-90-J-1193)
(AD-A235517; UBUFFALO/DC/91/TR-47) Avail: NTIS HC/MF A02 CSCL 07/2

The structure and properties of medium-size clusters, few tons of atoms, has been a subject of several recent theoretical and experimental studies. In particular, the question of the transition from high-coordinated structures, typical for small clusters, to tetra-coordinated diamond structures, which is the bulk limit, has attracted much interest and created discussions in the literature, although mainly based on theoretical arguments. Kaxiras' contribution to this discussion provides an interesting and well motivated model for Si33 and Si45 clusters with a tetra-coordinated core and a bulk silicon-like reconstructed surface structure, thus suggesting that the transition region might start already at a cluster size of about 40 atoms. While this may be the case, attention is drawn to the recent results for Si45 clusters, which suggest that the most stable isomers have still higher coordination numbers (from 4.0 to 4.2) than suggested by Kaxiras (about 3.1). GRA

N91-27253# Case Western Reserve Univ., Cleveland, OH.
IN SITU FTIR STUDY OF CO2 REDUCTION ON POLYCRYSTALLINE PLATINUM IN ACID SOLUTIONS Technical Report No. 71, 1989 - 1990
H. Huang, C. Fierro, D. A. Scherson, and E. Yeager 30 Oct. 1990 19 p
(Contract N00014-90-J-1212)
(AD-A235565) Avail: NTIS HC/MF A03 CSCL 07/4

The reduction of CO2 on polycrystalline Pt in 0.1 M HClO4 has been investigated with in situ Fourier Transform Infrared Reflection, Absorption Spectroscopy and electrochemical techniques. Both methods have provided clear evidence that the reaction proceeds at potentials at which adsorbed hydrogen is also present on the surface. Based on the spectroscopic information it has been concluded that linear and bridge-bonded forms of adsorbed CO are the only detectable reduction products with the latter achieving saturation coverage well before the peak associated with linearly bonded CO reaches maximum intensity. Two similar CO bands have also been observed by other authors for CO2 reduction on Pt in 0.5 M using the EMIRS technique. The low energy band, however, was described by these authors to CO bound on a three-fold site. GRA

N91-27254# Kentucky Univ., Lexington. Dept. of Chemistry.
PREPARATION OF UNSYMMETRICALLY B-SUBSTITUTED BORAZINES AND CHARACTERIZATION OF TRIS(4,6-DIETHYLBORAZIN-2-YL)AMINE
J. Bai, K. Niedenzu, J. Serwatowska, and J. Serwatowski May 1991 20 p
(Contract N00014-83-K-0611)
(AD-A235571; UK/DC/TR-34) Avail: NTIS HC/MF A03 CSCL 07/3

Borazine is the foremost example of an inorganic compound that can be closely compared to an organic species, i.e., benzene. Hence, studies on this six-membered B3N3 heterocyclic system have been popular and literally hundreds of borazine derivatives are known. However, most of them are symmetrically substituted species of the type (RBNR). Relatively few unsymmetrically substituted derivatives have been described and their chemistry has been investigated only sparingly. Within the context of preparative studies on discrete polycyclic boron-nitrogen systems as potential precursors for macromolecular materials, the synthesis of the tris(borazin-2-yl) amine framework seemed to be an interesting point of origin. Detailed studies such species require convenient access to unsymmetrically B-substituted borazines of the types XR2B3N3R3 and X2RB3N3R3 (and where X is a reactive site) in highly purity. The present report describes the preparation and characterization of various such unsymmetrically B-substituted borazines as well as attempts to synthesize the tris(borazin-2-yl)amine skeleton. GRA

N91-27255# Florida Univ., Gainesville. Dept. of Chemistry.
A GLOW DISCHARGE ION SOURCE WITH FOURIER TRANSFORM ION CYCLOTRON RESONANCE MASS SPECTROMETRIC DETECTION Technical Report No. 34, Aug. 1990 - Mar. 1991
C. M. Barshick and J. R. Eyler 10 May 1991 24 p
(Contract N00014-87-J-1248)
(AD-A235575) Avail: NTIS HC/MF A03 CSCL 14/2

A glow discharge ion source has been coupled to a Fourier transform ion cyclotron resonance mass spectrometer using a series of four electrostatic lenses to accelerate and focus ions generated external to the instrument's high magnetic field into its analyzer cell. Like other glow discharge mass spectrometers, glow discharge-Fourier transform ion cyclotron resonance can provide a quantitative measure of bulk analyte concentration with good precision and accuracy. Although detection limits currently attainable are several orders of magnitude higher than the commercially available magnetic sector based instrument, this approach holds promise for ultra high mass/ultra high resolving power mass analysis. Several schemes are proposed to lower the detection limits of the technique while still providing high enough resolution to resolve isobaric interferences. GRA

N91-27256# Geo-Centers, Inc., Newton, MA.
NOVEL CHEMICAL AND OPTICAL DIAGNOSTIC TECHNIQUES Final Report, 22 Sep. 1986 - 29 Jan. 1991
Karen P. Crossman, Patricia T. Carver, and Scot Reynolds Mar. 1991 451 p
(Contract N00014-86-C-2266)
(AD-A235587; GC-TR-91-1691) Avail: NTIS HC/MF A20
CSCL 14/2

The tasks performed at NRL in support of Research of Novel Chemical and Optical Diagnostic Techniques are reported. GEO-CENTERS' support at NRL addressed existing problems in these areas: citric acid hydrazines sampler; photoionization; materials compatibility; electrochemistry; color chemistry for the detection of nitrogen dioxide (NO2); nitrogen dioxide instrument evaluation; coulometric titration method optimization; color chemistry for detection of HCl; as well as additional studies. GRA

N91-27257# Wyoming Univ., Laramie. Dept. of Chemistry.
ENVIRONMENTAL EFFECTS ON REDOX POTENTIALS OF VIOLOGEN GROUPS EMBEDDED IN ELECTROACTIVE SELF-ASSEMBLED MONOLAYERS Technical Report No. 14, Sep. 1990 - Jun. 1991
Hugh C. DeLong and Daniel A. Buttry 29 Apr. 1991 19 p
(Contract N00014-90-J-1167)
(AD-A235676) Avail: NTIS HC/MF A03 CSCL 07/4

The electrochemical behavior of a new class of redox surfactant capable of forming electroactive, self-assembled monolayers was described. These compounds have redox moieties derived from the well known viologens, which display two distinct, reversible, one-electron couples. Their well behaved electrochemistry has led to their use in a variety of studies ranging from electron transfer mediation to redox proteins to surface enhanced Raman studies of adsorption at electrode surfaces to the behavior of supermolecular assemblies at electrode surfaces. Interest in understanding the influence of ionic interactions and solvation processes on redox behavior in such supermolecular assemblies led to the synthesizing of several of these compounds and study their redox behavior in such assemblies using both electrochemical (cyclic voltametric, CV) and quartz crystal microbalance (EQCM) techniques. The strong dependence is described of the redox potential of the viologen moiety on its exact position within the assembly (i.e., with respect to the monolayer/electrode and monolayer/solution interfaces) and expand on a previous report of the dependence of electrochemical behavior on the type of anion present within the monolayer assembly. GRA

N91-27258# Case Western Reserve Univ., Cleveland, OH. Dept. of Macromolecular Science.
AN INFRARED ANALYSIS OF THE EFFECT OF COMPOSITION OF N-BUTYL TRIETHOXYSILANE AND GAMMA-AMINO PROPYL TRIETHOXYSILANE BLENDS ON TERTIARY AMINE-CATALYZED ANHYDRIDE-CURED EPOXY MIXTURES
S. L. Tidrick, Hatsuo Ishida, and J. L. Koenig May 1991 33 p
(Contract N00014-88-R-0330)
(AD-A235840; CWRU/DMS/TR-41) Avail: NTIS HC/MF A03
CSCL 07/6

The enhancement in mechanical properties observed for silane-treated glass-reinforced epoxy materials is highly dependent on the structure of the coupling agent at the interphase. The effect of varying composition of nonhydrolyzed silane coupling agent blends of gamma amino propyl triethoxysilane (APS) and butyl triethoxysilane (BTS) on the cure of benzyl dimethylamine (BDMA)-catalyzed, nadic methyl anhydride (NMA)-cured diglycidyl ether of bisphenol-A epoxy (BDGE) was studied by Fourier transform infrared spectroscopy (FTIR). The silane blends perturbed the kinetics of the alternating anhydride-epoxy copolymerization reaction, with the perturbation being a nonlinear function of the relative amine concentration in the system. GRA

N91-27259# Case Western Reserve Univ., Cleveland, OH. Dept. of Macromolecular Science.
THE 29Si SOLID STATE NMR STUDIES OF THE EFFECT OF COMPOSITION OF AMINE AND ALKYL SILANE BLENDS IN TERTIARY AMINE-CATALYZED ANHYDRIDE-CURED EPOXY MIXTURES
S. L. Tidrick, Hatsuo Ishida, and J. L. Koenig May 1991 19 p
(Contract N00014-88-R-0330)
(AD-A235841; CWRU/DMS/TR-42) Avail: NTIS HC/MF A03
CSCL 07/6

Silane coupling agent blends of gamma amino propyl triethoxysilane (APS) and butyl triethoxysilane (BTS) of varying composition were added to an epoxy matrix made of a benzyl dimethylamine (BDMA)-catalyzed, nadic methyl anhydride (NMR) was utilized in order to determine the effect of composition of the silane coupling agent blend on the mobility of the various portions of the siloxane network. It was found that hydrolysis caused an increase in the rigidity of the highly condensed structures, but decreased the rigidity of the silicon atoms bonded to only one or two oxygen atoms. This phase separation could possibly lead to stress concentration within the network structure. Increasing amine concentration caused only slight increases in rigidity. Although ETS gave consistently lower rigidity values than BTS, these values were not statistically significant. GRA

N91-27260# Case Western Reserve Univ., Cleveland, OH. Dept. of Macromolecular Science.
AN INFRARED ANALYSIS OF THE EFFECT OF COMPOSITION OF SILANE BLENDS OF AMINO AND ALKYL SILANE BLENDS IN TERTIARY AMINE-CATALYZED ANHYDRIDE-CURED EPOXY MIXTURES
S. L. Tidrick, Hatsuo Ishida, and J. L. Koenig May 1991 42 p
(Contract N00014-88-R-0330)
(AD-A235842; CWRU/DMS/TR-40) Avail: NTIS HC/MF A03
CSCL 07/6

The property enhancement caused by silane coupling agents in glass-reinforced epoxy matrices is a function of the structure and composition of the silane. The effect of hydrolyzed and nonhydrolyzed of various compositions of silane coupling agent blends of gamma amino propyl triethoxysilane (APS) and either butyl triethoxysilane (BTS) or ethyl triethoxysilane (ETS) on the cure of a benzyl dimethylamine (BDMA)-catalyzed, nadic methyl anhydride (NMA) cured diglycidyl ether of bisphenol-A type epoxy were investigated by Fourier transform infrared spectroscopy (FTIR). The presence of the amine group perturbs the alternating copolymerization of the anhydride and epoxy groups by initiating and catalyzing the reaction. Hydrolysis also promoted the reaction rate. Samples containing ETS cured more rapidly than those containing BTS at the same composition. Imide formation was not significant in the presence of the alkyl-ended silanes. A very simple mathematical simulation was invoked to justify assumptions made during data analysis. GRA

N91-27261# Carnegie Inst. of Tech., Pittsburgh, PA. Dept. of Chemistry.
STRUCTURAL AND ACIDIC PROPERTIES OF NIOBIA-SILICA AND NIOBIA-ALUMINA AEROGELS Ph.D. Thesis Final Report, 1 Jun. 1988 - 6 May 1991
Scott M. Maurer 6 May 1991 510 p Sponsored by Department of the Army
(AD-A235864) Avail: NTIS HC/MF A22 CSCL 07/4

This study used a variety of techniques to establish the structural-chemical property relationships over niobia, niobia-silica, and niobia-alumina binary oxide aerogels. The objective is to develop a comparative set of samples of known structure for chemical characterization. Bulk oxide aerogels of niobia, alumina, and silica were prepared as base oxides by the sol-gel method followed by supercritical extraction to dry the solvent-ladened gel. The synthesis of the bulk niobia aerogel was followed by a 500 C calcination and yielded the highest surface area, 190 sq m/g ever reported for bulk niobia. Other physical properties of the aerogel of niobia such as total pore volume and average pore diameter were significantly higher than found previously for conventionally

prepared niobia. Laser Raman Spectroscopy (LRS) and pyridine adsorption experiments were used to investigate the structural and chemical properties of the niobia aerogel as a function of heat treatment. GRA

N91-27262# Naval Postgraduate School, Monterey, CA. Dept. of Mechanical Engineering.
A PREDICTIVE METHOD TO DESCRIBE THE BOILING BEHAVIOR OF REFRIGERANT-OIL MIXTURES Final Report, 1 Apr. - 30 Sep. 1990
John R. Lloyd and Paul J. Marto 31 Dec. 1990 38 p
(AD-A235872; NPS-ME-90-07) Avail: NTIS HC/MF A03 CSCL 20/13

The need for efficient and environmentally safe refrigerants is of great concern to the Navy, and is driving them to explore the performance of alternate refrigerants for use in shipboard evaporators. Each time a new refrigerant is considered, one must also consider how oil contamination will affect its performance. The present study surveys the literature for a predictive technique to calculate the nucleate boiling heat transfer behavior of refrigerant-oil mixtures that is fundamental to the operation of refrigerant systems. There were three expressions found that could be considered for use. These expressions for the nucleate boiling heat transfer were empirically based formulations, which means that a new series of experiments must be conducted every time a different refrigerant-oil combination is considered for use. An expression that is currently under development for mixtures in general was found that is based only upon the thermophysical properties of the fluids and their mixtures. No empirical constants are necessary. The mass diffusion coefficient of the oil in the refrigerant is found to be the key property to be measured in order to evaluate the predictive capability of this expression. Experiments are proposed to obtain this key property and then to this expression will be developed as the experiments indicate are necessary. GRA

N91-27263# Cornell Univ., Ithaca, NY.
FROM CHEMISORPTION TO MECHANISM ON SURFACES: AN EXPLORATION OF THE PYROLYSIS OF TRIISOBUTYLALUMINUM IN THE CHEMICAL VAPOR DEPOSITION OF ALUMINUM THIN FILMS
A. W. Chan and Roald Hoffmann 25 Apr. 1991 28 p
(Contract N00014-89-J-1052)
(AD-A235879; TR-55) Avail: NTIS HC/MF A03 CSCL 07/4

The chemisorption of H, CH3, C2H5, and C2H4 is examined on Al(111) and Al(100) surfaces by the extended Huckel method, using a tight-binding formalism. A local chemical viewpoint is sought through fragment analyses, decompositions of the density of states and overlap populations. Various adsorption sites were studied. On both surfaces, the first three species prefer to bind in the on-top site by an interaction with the coordinated Al atom. Ethylene, on the other hand, favors the 2-fold bridging site by a bonded interaction with its HOMO and LUMO. In addition, the mobility of all these species on surfaces is investigated. Finally, the mechanism for the thermal decompositions of the triisobutylaluminum is studied. A Beta-hydride elimination rate determining step is established, in which the activation barrier of the reaction in A(111) is lower than Al(100). This result is in agreement with the experimental findings. GRA

N91-27264# Waterloo Univ. (Ontario). Dept. of Chemistry.
VIBRATIONAL SPECTROSCOPIC STUDIES OF ELECTRODE SURFACES AND TECHNOLOGICALLY IMPORTANT ELECTROLYTE SOLUTIONS Final Report, 1987 - 1990
Donald E. Irish 15 May 1991 5 p
(Contract N00014-87-J-1118)
(AD-A235892) Avail: NTIS HC/MF A01 CSCL 07/4

Laser Raman spectroscopy has been coupled with electrochemical techniques such as chronocoulometry and cyclic voltammetry to study the species adsorbed on electrode surfaces and to monitor processes which occur with changes in electrode potential, solvent properties, laser exciting line wavelength, solute and other variables. Lithium metal surfaces were studied with the Raman microprobe; decomposition products, polymerization and conditions for this, and photo-currents were studied. Work was extended to the solvents methylacetate and propylene carbonate. Studies of selected aqueous electrolyte systems were conducted for comparison. Chronocoulometry was used to measure pyridine adsorption for single crystal and polycrystalline gold surfaces. In situ Raman spectra of smooth gold surfaces provided information about coverage in agreement with the isotherms from electrochemistry; the effect of surface roughness on the Raman intensity - potential profiles was measured. Studies of the identity and morphology of surface films that inhibit (or vice versa) the cycling efficiency of proposed lithium batteries were studied; voltage-time transients from freshly cleaved lithium surfaces were measured for a range of solvent-solute combinations. GRA

N91-27265# Indiana Univ., Bloomington. Dept. of Physics.
VIBRATIONAL SPECTROSCOPY OF ORDERED OXYGEN ADLAYERS ON Ni/Cu(001) AND Co/Cu(001) THIN FILM SYSTEMS
J.-S. Kim, M. H. Mohamed, and L. L. Kesmodel 15 May 1991 27 p
(Contract N00014-89-J-1775)
(AD-A235921; TR-5) Avail: NTIS HC/MF A03 CSCL 09/1

Surface vibrations in c(2x2) oxygen adlayers on Ni and Co thin films on a Cu (001) substrate measured at gamma by high resolution EELS are reported. For the Ni thin film surface, one phonon peak is measured for varying film thickness from 1.3 ML (monolayer) to 6 ML with a constant energy of 221/cm. For the CO thin film surface, three loss peaks are found, whose relative intensities change as the film thicknesses are varied. One loss peak ca. 520/cm is tentatively assigned to the Fuchs-Kliewer mode of cobalt oxide (CoO). The other two peaks at 317/cm and 376/cm are likely related to different bonding sites. Surface phonons on the p(2x2) Co thin film (389/cm) and a bulk resonance mode (115/cm) are also reported. GRA

N91-27266# Indiana Univ., Bloomington. Dept. of Physics.
CATALYTIC ACTIVITY OF MODEL Pt/Al2O3 CATALYSTS: THE ROLE OF CHLORINE
I. Boszormenyi, G. A. Somorjai, and L. L. Kesmodel 1 May 1991 9 p
(Contract N00014-89-J-1775)
(AD-A235946; TR-4) Avail: NTIS HC/MF A02 CSCL 11/6

We have investigated the activity and regeneration of two model catalysts involving platinum and alumina. One catalyst involves alumina islands deposited on platinum foil and the second is formed by vapor deposition of platinum. Carbon monoxide adsorption and methyl cyclopentane hydrogenolysis reaction rates have been studied as a function of A10x and Pt coverage and in the presence of chlorine. GRA

N91-27267# Minnesota Univ., Minneapolis. Dept. of Chemistry.
NONEXPONENTIAL SOLVATION DYNAMICS OF SIMPLE LIQUIDS AND MIXTURES
Wlodzimierz Jarzeba, Gilbert C. Walker, Alan E. Johnson, and Paul F. Barbara 6 May 1991 16 p
(Contract N00014-89-J-1746)
(AD-A235968; TR-6) Avail: NTIS HC/MF A03 CSCL 07/4

Novel measurements on the microscopic solvation dynamics of coumarin probes in several simple polar solvents and mixtures have been made using the time dependent fluorescence Stokes shift technique. The microscopic solvent relaxation function, C(t), is observed to be poorly modeled by a single exponential decay in many cases. The average experimental solvation times, for pure solvents and binary solvent mixtures are close to values predicted by dielectric continuum theory. The results suggest that molecular motion of solvent molecules near the solute can be responsible for microscopic solvation components of C(t) that are not predicted using bulk dielectric data of the neat solvent and the dielectric continuum theory. GRA

N91-27268# Phillips Lab., Edwards AFB, CA.
ABSOLUTE CONCENTRATION MEASUREMENTS OF FREE RADICALS IN FLAMES BY ABSORPTION SPECTROSCOPY Final Report, Aug. 1990 - Jan. 1991
S. Zabarnick and D. A. Alspach Apr. 1991 42 p
(AD-A236032; PL-TR-91-3012) Avail: NTIS HC/MF A03
CSCL 07/4

Absorption spectroscopy techniques were used for measurement of absolute concentrations of free radical species in premixed, laminar, flat-flames of methane/nitrous oxide and CH4/nitric oxide/oxygen. Absolute concentration measurements were performed for the hydroxyl radical, cyanide radical, and imino radical in 63 Torr flames. These absolute concentration measurements were used to calibrate relative concentration profiles taken in previous experiments using laser-induced fluorescence (LIF) spectroscopy. Significant absorptions of these species could be obtained even in the very short path length flames studied. These measurements permit the experimental LIF measurement to be directly compared to the species concentration profiles predicted by the CHEMKIN/PREMIX flames modeling code. GRA

N91-27269# Utah Univ., Salt Lake City. Dept. of Chemistry.
ATTENUATED TOTAL REFLECTION INFRARED SPECTROSCOPY FOR MEASURING INTERFACIAL REACTION KINETICS: HYDROLYSIS OF MONOCHLOROSILANES AT SILICA SURFACES Technical Report No. 29, Jun. 1990 - May 1991
D. B. Parry, W. B. Lacy, G. R. Phillips, and J. M. Harris 22 May 1991 31 p
(Contract N00014-89-J-1412)
(AD-A236034) Avail: NTIS HC/MF A03 CSCL 07/4

Attenuated total reflection, Fourier transform infrared (ATR-FTIR) spectroscopy is used to obtain kinetic and mechanistic information about reactions at liquid/solid interfaces. Time-dependent changes in the infrared absorbance are related to the accumulation or loss of species at the interface due to adsorption, desorption, or chemical reaction. In the present work, an oxidized silicon ATR substrate is used as a model silica surface to study the interfacial reaction kinetics of diphenylchlorosilane (DPCS). The identity of the reacting species is determined by infrared spectroscopic characterization of DPCS and its condensation products. The solubility of the silica-adsorbed species in solution provides confirming evidence of product identity as well. The work addresses questions about the time-scale of siloxane binding, and finds that hydrolysis with water on the silica surface precedes binding to the surface, even in dry solvents. The hydrolysis reaction kinetics are analyzed in terms of a Langmuir-Hinshelwood model for surface reactions. The lack of a dependence of the kinetics on solution concentration of reagent and the matched loss of adsorbed DPCS indicates that hydrolysis of the chlorosilane occurs from an adsorbed monolayer of the reagent. The adsorption kinetics of DPCS to silica are also reported. GRA

N91-27270# Brigham Young Univ., Provo, UT. Dept. of Chemistry.
DEPENDENCE OF THE LOG K VALUES FOR THE INTERACTION OF CHIRAL DIMETHYLPYRIDINO-18-CROWN-6 WITH ALPHA-(1-NAPHTHYLETHYL) AMMONIUM PERCHLORATE ON SEVERAL SOLVENT PARAMETERS Interim Report
C. Y. Zhu, R. M. Izatt, and J. S. Bradshaw 20 May 1991 2 p
(Contract N00014-91-J-1710)
(AD-A236088; TR-2) Avail: NTIS HC/MF A01 CSCL 07/3

The log K values for the complexation of chiral dimethylpyridino-18-crown-6 with the (R)- and (S)- enantiomers of alpha-(1-naphthylethyl)-ammonium perchlorate were determined by the direct H-1 NMR technique in variety of solvents. The crown and salt are shown with the log K values. It is clear from the data that the magnitude of log K correlates well with the solvent donor number but there is no correlation between log K values and the dielectric constant, acceptor number or empirical polarity of each constant. Solvents with low donor numbers allowed the most stable complexation as would be expected. Solvents with high donor numbers would form strong solvent associations with the guest so that guest molecules would be less available for the chiral ligand. DMSO-d6 associates so strongly with the ammonium salt that no complexation with the ligand was observed. GRA

N91-27271# Iowa Univ., Iowa City. Dept. of Mechanical Engineering.
WICK-TYPE LIQUID-METAL COMBUSTION Final Report, 15 Oct. 1988 - 14 Apr. 1991
L.-D. Chen, H. Y. Lyu, and K. Y. Hsu May 1991 85 p
(Contract N00014-89-J-1188)
(AD-A236204) Avail: NTIS HC/MF A05 CSCL 11/6

An investigation was conducted to study wick combustion of Li and SF6. A single-line laser induced fluorescence thermometry with Li2 as the fluorescence species was developed. Wick combustion of Li and SF6 was conducted in vacuum chamber at sub-atmospheric pressures. The combustion results in a bright pinkish flame. Emission spectra showed that the flame luminosity is dominated by the resonance-emission line of Li atoms. On analysis, a conserved scalar approach was employed to model the wick flame. A single equation was obtained to describe the interface condition of wick combustion. Numerical solutions were obtained for laminar wick diffusion flames. The prediction yields similarity profiles for planar Li-SF6 wick diffusion flames, but similarity solutions are not obtained for cylindrical wick diffusion flames. Cylindrical wick diffusion flames are found to deviate substantially from the planar geometry. The effects on mass burning rates due to fuel composition variations were studied employing fuel-rich and product-rich liquids at 0.0035 MPa in the analysis. Product-rich fuel yielded a much lower flame temperature; the mass burning rate, however, was higher than the pure lithium at 0.01 MPa. Results suggest that wick configuration may achieve a higher fuel utilization than the submerged jet. GRA

N91-27272# Case Western Reserve Univ., Cleveland, OH. Center for Electrochemical Sciences.
INVESTIGATION OF PHENOMENA RELATED TO D2O ELECTROLYSIS AT A PALLADIUM CATHODE Technical Report No. 80, 1989 - 1990
R. R. Adzic, D. Gervasio, B. Cahan, I. Bae, and E. Yeager 30 Oct. 1990 21 p
(Contract N00014-90-J-1212)
(AD-A236409) Avail: NTIS HC/MF A03 CSCL 07/4

Measurements have been carried out on the phenomena reported by Fleischmann and Pons to occur during the electrolysis of D2O solutions with a palladium cathode. The measurements include: (1) the determination of tritium concentrations in the cells; (2) the determination of the D/Pd ratios by coulometry; (3) surface analysis of the Pd cathode; and (4) neutron radiation measurements. Enhancement of tritium in the D2O solution was found in two open-type glass cells as well as in four other cells with Ni anodes. The largest enhancement factor found was 50. The source of this enhancement remains unexplained. Surface analysis revealed a number of impurities on the Pd surface including Si, Pt (with Pt anodes), and Li. The latter was found to penetrate 200 rm into the Pd bulk. The neutron measurements were inconclusive. GRA

N91-27273# Cornell Univ., Ithaca, NY. Dept. of Chemistry.
SYNTHESIS, STRUCTURE, AND PROPERTIES OF ANTI-PEROVSKITE NITRIDES Ca3MN, M=P, As, Sb, Bi, Ge, Sn, AND Pb
Ming Y. Chern, Deborah A. Vennos, and F. J. DiSalvo 30 May 1991 30 p
(Contract N00014-91-J-1269)
(AD-A236589; TR-8) Avail: NTIS HC/MF A03 CSCL 07/2

A family of anti-perovskite nitrides of the formula Ca3MN, where M is a Group IV or a Group V element, is reported. Ca3BiN, synthesized by mixing and pressing powders of Ca3N2 and Bi into a pellet and subsequently heating the pellet at 1000 C in flowing, dry N2 gas, is prototypical of this family of compounds.

The bismuth in Ca3BiN has an uncommon oxidation state of 3(-) as suggested by the properties (semiconducting and diamagnetic) of the compound. The anionic bismuth can be substituted for by other trivalent anions Sb3(-), As3(-), and P3(-) as expected. The structure of Ca3AsN and Ca3PN are distorted from the simple cubic anti-perovskite cell at room temperature because of the small size of As3(-) and P3(-). More interestingly, Ca3N2 also reacts with Ge, Sn, and Pb at 1300 C to form similar anti-perovskites, resulting in metallic phases and the unusual open shell oxidation state of 3(-) for the Group IV elements. GRA

N91-27274# Cornell Univ., Ithaca, NY.
NUMERICAL INVESTIGATION OF TURBULENT FLAME SHEETS Final Report, Dec. 1987 - Dec. 1990
Stephen B. Pope 29 Mar. 1991 16 p
(Grant AF-AFOSR-0052-88; AF Proj. 2308)
(AD-A236650; AFOSR-91-0503TR) Avail: NTIS HC/MF A03 CSCL 07/4

An accurate physical model of a premixed turbulent flame (in the flamelet regime) is that combustion is confined to a thin sheet that can be regarded as a mathematical surface. This surface is convected and bent by the fluid motion, and it propagates normal to itself (relative to the fluid) at the local laminar flame speed. Direct numerical simulations have been performed to examine the important properties of material (i.e., non-propagating) and propagating surfaces in turbulence. The results have been described in seven papers. The straining, curvature and cusp formation of these surfaces has been well characterized. GRA

N91-27275# California Univ., San Diego, La Jolla.
THEORIES OF TURBULENT COMBUSTION IN HIGH SPEED FLOWS Annual Report, Apr. 1990 - Apr. 1991
P. A. Libbey and F. A. Williams 2 Apr. 1991 6 p
(Grant AF-AFOSR-0310-89; AF Proj. 2308)
(AD-A236652; AFOSR-91-0505TR) Avail: NTIS HC/MF A02 CSCL 07/4

Since Damkohler and Reynolds numbers over the range of conditions relevant to supersonic hydrogen-air combustion were found to be consistent with the combustion occurring in the reaction-sheet regime, detailed numerical integrations were performed on the structures of counterflow hydrogen-air diffusion flames, for pressure from 0.5 to 10 atm and air temperatures from 300 K to 1200 K, at a hydrogen temperature of 300 K. The results showed extinction to occur at high enough rates of strain in most cases, but no extinction for air temperatures above 1000 K. Nitrogen chemistry was shown to have a negligible effect, and reduced chemical-kinetic mechanisms were developed for simplifying the computations. The compound extinction strain rates were found to be in excellent agreement with newly performed experiments. Compressibility effects are being taken into account, and the results are being worked into methods for describing turbulent combustion in high-speed flows. GRA

N91-27276# Puerto Rico Univ., Rio Piedras. Dept. of Chemistry.
COLLISION INDUCED ELECTRONIC QUENCHING OF ALUMINUM MONOXIDE
A. P. Salzberg, David I. Santiago, Federico Asmar, Deig Sandoval, and Brad R. Weiner Jan. 1991 24 p
(Contract N00014-89-J-1829)
(AD-A236681; TR-1) Avail: NTIS HC/MF A03 CSCL 11/6

A better understanding of the chemistry of small metal-containing molecules is fundamental to our comprehension of homogeneous catalysis and activation of small molecules. Metal oxides are one class of compounds that may be important intermediates in catalytic systems, yet the reaction dynamics of gas phase diatomic metal oxides have not been studied extensively, primarily because of the difficulty in producing them cleanly. Previous methods have included high temperature ovens, shock tubes, exploding wire, flames and flow reactors to produce gas phase metal atoms, which have been subsequently oxidized. Recently, the use of focussed lasers has been exploited to produce metal atoms by either multiphoton dissociation of organometallic compounds or by laser vaporization of pure metals. GRA

N91-27277# North Carolina Univ., Chapel Hill. Dept. of Computer Science.
GENERATING TEXTURES FOR ARBITRARY SURFACES USING REACTION-DIFFUSION
Greg Turk 1990 21 p
(Contract N00014-86-K-0680; NSF DCI-86-01152)
(AD-A236706) Avail: NTIS HC/MF A03 CSCL 07/4

For all but the most simple geometric models it is difficult to find a mapping from a two-dimensional texture space to the surface of a model that does not distort the texture. This paper introduces a method of texture synthesis where such a mapping is not necessary because the texture is generated directly on the surface of the model. No assignment of texture coordinates to polygon vertices is needed. We describe how to generate a mesh of points on a polyhedral model using a relaxation process and how this mesh is used to generate textures. There is no distortion from such a texture because the geometry of the texture matches the geometry of the model. These textures can be rendered free of artifacts resulting from the discrete nature of the underlying mesh or due to aliasing of the texture features. Such textures can also be used as bump maps. We demonstrate how a pattern formation mechanism called reaction-diffusion can be simulated on a such mesh to create a variety of patterns found in nature. Reaction-diffusion is an addition to the growing collection of procedural methods found in the texture synthesist's toolbox. Biologists have shown how the chemical mechanism of reaction-diffusion can be used to form simple spotted and striped patterns. GRA

N91-27278# Naval Postgraduate School, Monterey, CA. Dept. of Mathematics.
A COMMENT ON THE DERIVATION OF THE LANGMUIR ISOTHERM FOR THE ADSORPTION KINETICS Technical Report, Feb. - Apr. 1991
Chris Frenzen 1 Apr. 1991 14 p
(AD-A236709; NPS-MA-91-010) Avail: NTIS HC/MF A03 CSCL 07/4

The justification for the use of the Langmuir isotherm, basically an equilibrium relation, to relate the subsurface concentration C(t) at time t to the adsorbed surface concentration Gamma (t) depends, in many adsorption kinetics models, on the presence of two very different time scales. Though this was implicit in the recent derivation, it was not specifically pointed out. The second long time scale is particularly important because it governs the time evolution of C(t), the subsurface concentration, and helps to determine when the Langmuir isotherm approximation is valid. Here the Langmuir isotherm is derived mathematically from the adsorption kinetics equations governing the surface concentration, the subsurface concentration, and the bulk phase adjacent to the surface. GRA

N91-27279# Duke Univ., Durham, NC. Dept. of Chemistry.
THE USE OF SILYLARSINES TO PREPARE GALLIUM-ARSENIC COMPOUNDS
Richard L. Wells 5 Jun. 1991 39 p
(Contract N00014-89-J-1545)
(AD-A236742; DU/DC/TR-20) Avail: NTIS HC/MF A03 CSCL 07/2

A number of gallium arsenic compounds/systems were realized by applying the general method of synthesis referred to as dehalosilylation between a silylarsine and a halogallane. Among those prepared are bis and tris(arsino)gallanes, with one of the latter being isolated as the monomer, a compound containing a single Ga3As unit, and compounds containing rings with arsenic, halogen mixed-bridging of gallium centers. Also, this method was utilized to prepare gallium arsenide. The methodologies developed in these studies are currently being applied to the synthesis of additional new gallium arsenic compounds/systems, and they are finding much practicality in the synthesis of other related III-V species. For example, the indium-arsenic compound was recently

isolated and characterized along with its phosphorus analog. The fact that these two indium compounds can be prepared adds credence to our suggestion that mixed-bridge compounds may be common species in the area of chemistry involving the heavier elements of Groups III and V. GRA

N91-27280# Stanford Univ., CA. High Temperature Gasdynamics Lab.
TURBULENT REACTING FLOWS AND SUPERSONIC COMBUSTION Annual Report, 15 Feb. 1990 - 14 Feb. 1991
C. T. Bowman, R. K. Hanson, M. G. Mungal, and W. C. Reynolds 15 Mar. 1991 27 p
(Contract AF-AFOSR-0151-90; AF Proj. 3484)
(AD-A236759; AFOSR-91-0506TR) Avail: NTIS HC/MF A03 CSCL 21/2

An experimental and computational investigation of supersonic non-reacting and combustion flows is in progress. The principal objective of the research is to gain a more fundamental understanding of mixing and chemical reaction in supersonic flows. The research effort comprises three inter-related elements: an experimental study of mixing and combustion in a supersonic plane mixing layer; development of laser-induced fluorescence techniques for time-resolved two-dimensional imaging of species concentration, temperature, velocity and pressure; and, numerical simulations of compressible reacting flows. The specific objectives and the status of the research of each of these program elements are summarized in this report. GRA

N91-27281# California Univ., Davis. Dept. of Chemistry.
THE ADSORPTION OF BROMIDE ION AT MERCURY FROM PROPYLENE CARBONATE SOLUTIONS OF CONSTANT IONIC STRENGTH
W. Ronald Fawcett and Artur J. Motheo 20 May 1991 33 p
(Contract N00014-90-J-1235)
(AD-A237020; TR-11) Avail: NTIS HC/MF A03 CSCL 07/4

The adsorption of Br anion has been studied from propylene carbonate solutions of low ionic strength (0.16 M) at mercury. A maximum on the capacity curve is observed at low Br ion concentration, a result of which is unusual for strongly absorbed ions. A new method of analyzing the interfacial thermodynamic data are available, which makes use of data obtained in the absence of Br ion is presented. Absorption is shown to be very strong and can be represented by a virial absorption isotherm over the range that data are available. The adsorption parameters can be rationalized on the basis of the electrostatic model for absorption with the proviso that the system is complex because of varying inner layer parameters for a given electrode charge density. When the present data are compared with those obtained in other solvents, it is shown that the standard Gibbs energy of adsorption changes with solvent acidity and basicity due to corresponding changes in anion solvation in the bulk, and the Gibbs energy of solvent adsorption on mercury, respectively. The adsorption parameters at the point of zero charge are examined with respect to non-primitive statistical mechanical models for ionic adsorption, discussed recently in the literature. GRA

N91-27282# TRW Space Technology Labs., Redondo Beach, CA. Center for Propulsion Technology and Fluid Mechanics.
BASIC RESEARCH ON FLAME RADIATION Final Report, Aug. 1986 - Feb. 1991
G. F. Carrier, F. E. Fendell, C. T. Hsu, I. L. Stonich, and L. D. Bergerson Feb. 1991 52 p
(Contract GRI-5086-260-1415)
(PB91-182980; TRW-S/N-48027; GRI-91/0091) Avail: NTIS HC/MF A04 CSCL 21B

A rapid compression facility was devised for measuring the rates of inception, growth, and collisional aggregation of soot in hydrocarbon/inert gas (especially, methane/inert gas) mixtures over a range of temperatures (1300 to 2300 K) over a range of pressures (up to 4 MPa). The facility is designed to maintain thermodynamic states in the above-cited, soot producing range for a temporal interval on the order of 100 ms. The preselected test sample is compressed from its initial volume into a subvolume owing to the rapid transit of a long gun barrel (approx 2.75 m) by a gas driven piston, which is in the shape of a frustum of a cone joined to a cylindrical afterbody. More precisely, a cylindrical nose piece is added on to the downwind end of the frustum, so that the test sample is ensconsed in the test section with only moderate sample churning and without any piston bounce. The temperature history in time is inferred from the measured variation of pressure in time. In turn, the mass of soot is inferred as a function of time, and the assignment of parameters in an empirical expression for the rate of soot formation then follows. Systematic data collection has been initiated. GRA

N91-27283# National Inst. of Standards and Technology, Gaithersburg, MD. Center for Fire Research.
MODERN TEST METHODS FOR FLAMMABILITY
V. Babrauskas Jun. 1990 25 p
(PB91-167676; NISTIR-4326) Avail: NTIS HC/MF A03 CSCL 21B

During the last decade significant improvements have become available in flammability testing. Rationally based new methods, derived from fundamental engineering principles are replacing the previously used empirical tests. The major emphasis in the development work has been to provide a basic set of bench scale methods which can be used to predict full scale product performance. Reference methods for conducting full scale tests will continue to be needed to handle products or situations where the bench scale methods are not applicable. The bulk of the testing can now be fulfilled by use of bench scale tests which are not only simple to run, but are known to accurately predict the full scale performance. Author

N91-28085*# Texas Southern Univ., Houston. Dept. of Chemistry.
THE FORMATION AND STUDY OF TITANIUM, ZIRCONIUM, AND HAFNIUM COMPLEXES
Bobby Wilson, Sam Sarin, Laverne Smith, and Melanie Wilson *In* Alabama A & M Univ., NASA-HBCU Space Science and Engineering Research Forum Proceedings 1989 p 141-14 (For primary document see N91-28063 19-99)
Avail: NTIS HC/MF A23 CSCL 07D

N91-28087*# Alabama A & M Univ., Normal. Dept. of Physics.
PHASE CONJUGATION BY DEGENERATE FOUR WAVE MIXING IN DISODIUM FLUORESCEIN SOLUTION IN METHANOL
Hossin Abdeldayem, P. Chandra Sekhar, P. Venkateswarlu, and M. C. Geroge *In* Alabama A & M Univ., NASA-HBCU Space Science and Engineering Research Forum Proceedings 1989 p 162-17 (For primary document see N91-28063 19-99)
Avail: NTIS HC/MF A23 CSCL 07D

N91-28088*# Texas Southern Univ., Houston. Dept. of Chemistry.
POLAROGRAPHIC STUDY OF CADMIUM 5-HYDROXY 2-(HYDROXYMETHYL) 4H-PYRAN-4-ONE COMPLEX
Ray F. Wilson and Robert C. Daniels *In* Alabama A & M Univ., NASA-HBCU Space Science and Engineering Research Forum Proceedings 1989 p 171-18 Sponsored in part by DOE (For primary document see N91-28063 19-99)
Avail: NTIS HC/MF A23 CSCL 07D

26 METALLIC MATERIALS

Includes physical, chemical, and mechanical properties of metals, e.g., corrosion; and metallurgy.

N91-27284# Lawrence Livermore National Lab., CA.
INTERACTION OF SLOW HIGHLY-CHARGED IONS WITH A METAL SURFACE
J. N. Bardsley and B. M. Penetrante 1 Feb. 1991 4 p Presented at the 20th International Conference on Phenomena in Ionized Gases, Barga (Italy), 8-12 Jul. 1991

(Contract W-7405-eng-48)
(DE91-010470; UCRL-JC-106475; CONF-910711-4) Avail: NTIS HC/MF A01

The development of improved ions sources such as the Electron Beam Ion Trap has led to the availability of ions which carry over 100 keV of potential energy. Recent studies of the interaction of such highly-charged ions with solids have attracted the interest of both atomic physicists and surface scientists. A study is presented on ion-surface interaction based upon elementary field emission theory and a classical description of the dynamics of the plasma formed by the emitted electrons. Since the quantum level spacings are so low, there are many active electrons, and very little time is spent by each electron in a specific quantum state, it is believed that the use of classical dynamics will lead to a more accurate description than could be obtained using quantum theory with current computers. Furthermore, the treatment of the simultaneous interactions between many charged particles is much simpler in classical mechanics. DOE

N91-27285*# Virginia Univ., Charlottesville. Dept. of Materials Science.
NASA-UVA LIGHT AEROSPACE ALLOY AND STRUCTURES TECHNOLOGY PROGRAM (LA2ST) Progress Report, 1 Jan. - 30 Jun. 1991
Richard P. Gangloff 30 Jun. 1991 347 p
(Grant NAG1-745)
(NASA-CR-188626; NAS 1.26:188626; UVA/528266/MS91/108)
Avail: NTIS HC/MF A15 CSCL 11F

The general objective of the Light Aerospace Alloy and Structures Technology (LA2ST) Program is to conduct interdisciplinary graduate student research on the performance of next generation, light weight aerospace alloys, composites, and associated thermal gradient structures in close collaboration with Langley researchers. Specific technical objectives are established for each research project. Relevant data and basic understanding of material behavior and microstructure, new monolithic and composite alloys, advanced processing methods, new solid and fluid mechanic analyses, measurement advances, and a pool of educated graduate students are sought. For individual titles, see N91-27286 through N91-27297.

N91-27286*# Virginia Univ., Charlottesville. Dept. of Materials Science.
ENVIRONMENT ENHANCED FATIGUE OF ADVANCED ALUMINUM ALLOYS AND METAL MATRIX COMPOSITES
Donald C. Slavik and Richard P. Gangloff *In its* NASA-UVA Light Aerospace Alloy and Structures Technology Program (LA2ST) 30 Jun. 1991 p 26-44 (For primary document see N91-27285 19-26)
Avail: NTIS HC/MF A15 CSCL 11F

The environmental fatigue crack propagation behavior of advanced Al-Li-Cu based alloys and metal matrix composites is being characterized. Aqueous NaCl and water vapor, which produce atomic hydrogen by reactions on clean crack surfaces, are emphasized. The effects of environment sensitive crack closure, stress ratio, and precipitate microstructure are assessed. Mechanistic models are sought for intrinsic crack tip damage processes to enable predictions of cracking behavior outside of the data, metallurgical improvements in material cracking resistance, and insight on hydrogen compatibility. Author

N91-27287*# Virginia Univ., Charlottesville. Dept. of Materials Science and Engineering.
ELEVATED TEMPERATURE FRACTURE OF RS/PM ALUMINUM ALLOY 8009
William C. Porr, Jr., Leng Yang, and Richard P. Gangloff *In its* NASA-UVA Light Aerospace Alloy and Structures Technology Program (LA2ST) 30 Jun. 1991 p 45-83 (For primary document see N91-27285 19-26)
Avail: NTIS HC/MF A15 CSCL 11F

The fracture behavior of advanced powder metallurgy Al-Fe-V-Si alloy 8009 (previously called FVS0812) is being characterized under monotonic loads, as a function of temperature. Particular attention is focused on contributions to the fracture mechanism from the fine grained dispersoid strengthened microstructure, dissolved solute from rapid solidification, and the moist air environment. Time-dependent crack growth is characterized in advanced aluminum alloys at elevated temperatures with the fracture mechanics approach, and cracking mechanisms are examined with a metallurgical approach. Specific tasks were to obtain standard load crack growth experimental information from a refined testing system; to correlate crack growth kinetics with the j-integral and time dependent C(sub t)(t); and to investigate the intermediate temperature embrittlement of 8009 alloy in order to understand crack growth mechanisms. Author

N91-27288*# Virginia Univ., Charlottesville.
TEMPERATURE EFFECTS ON THE DEFORMATION AND FRACTURE OF Al-Li-Cu-In ALLOYS
John A. Wagner and Richard P. Gangloff *In its* NASA-UVA Light Aerospace Alloy and Structures Technology Program (LA2ST) 30 Jun. 1991 p 84-112 (For primary document see N91-27285 19-26)
Avail: NTIS HC/MF A15 CSCL 11F

The crack initiation and growth fracture resistance of Al-Cu-Li and Al-Cu-Li-In alloys were characterized and optimized for cryogenic tank applications. Presently, the effects of stress state and temperature is being determined on the fracture toughness and fracture mechanisms of commercially available Vintage 3 2090-T81 and experimental 2090+In-T6. Precracked J-integral specimens of both alloys were tested at ambient and cryogenic temperatures in the plane stress and plane strain conditions. Considering ambient temperature, results showed that 2090-T81 exhibited the highest toughness in both plane strain and plane stress conditions. For the plane strain condition, reasonable crack initiation and growth toughness of 1090-T81 are associated with a significant amount of delamination and transgranular fracture. Plane stress toughnesses were higher and fracture was characterized by shear cracking with minimal delaminations. In comparisons, the fracture behavior of 2090+In-T6 is significantly degraded by subgrain boundary precipitation. Toughness is low and characterized by intersubgranular fracture with no delamination in the plane stress or plane strain conditions. Intersubgranular cracking is a low energy event which presumably occurs prior to the onset of slip band cracking. Copious grain boundary precipitation is atypical of commercially available 2090. At cryogenic temperatures, both alloys exhibit increased yield strength, toughness, and amount of delamination and shear cracking. The change in fracture mode of 2090+In-T6 from intersubgranular cracking at ambient temperature to a combination of intersubgranular cracking, shear cracking, and delamination at cryogenic temperature is the subject of further investigation.
Author

N91-27289*# Virginia Univ., Charlottesville.
THE EFFECT OF TEMPERATURE ON THE FRACTURE TOUGHNESS OF WELDALITE(TM) 049
Cynthia L. Lach and Richard P. Gangloff *In its* NASA-UVA Light Aerospace Alloy and Structures Technology Program (LA2ST) 30 Jun. 1991 p 113-129 (For primary document see N91-27285 19-26)
Avail: NTIS HC/MF A15 CSCL 11F

The uncertain effect of temperature is characterized on the deformation and fracture behavior of Weldalite(TM) 049 from cryogenic to elevated temperatures. Fracture resistance is measured and the determination of fracture mechanisms emphasized, including slip plane cracking, high angle boundary delamination, subgrain boundary cracking, and microvoid coalescence. Microstructure is controlled to produce either predominantly T(sub 1) or T(sub 1) + delta (after Blankenship and Starke) and to examine the effect of dislocation-precipitate interaction on fracture toughness. Author

N91-27290*# Virginia Univ., Charlottesville. Dept. of Materials Science and Engineering.

MEASUREMENTS AND MECHANISMS OF LOCALIZED AQUEOUS CORROSION IN ALUMINUM-LITHIUM-COPPER ALLOYS

Douglas Wall and Glenn E. Stoner *In its* NASA-UVA Light Aerospace Alloy and Structures Technology Program (LA2ST) 30 Jun. 1991 p 130-148 (For primary document see N91-27285 19-26)

Avail: NTIS HC/MF A15 CSCL 11F

Summary information is included for electrochemical aspects of stress corrosion cracking in alloy 2090 and an introduction to the work to be initiated on the new X2095 (Weldalite) alloy system. Stress corrosion cracking (SCC) was studied in both S-T and L-T orientations in alloy 2090. A constant load TTF test was performed in several environments with a potentiostatically applied potential. In the same environments the electrochemical behavior of phases found along subgrain boundaries was assessed. It was found that rapid failure due to SCC occurred when the following criteria was met: E(sub BR,T1) is less than E(sub applied) is less than E(sub Br, matrix phase). Although the L-T orientation is usually considered more resistant to SCC, failures in this orientation occurred when the stated criteria was met. This may be due to the relatively isotropic geometry of the subgrains which measure approximately 12 to 25 microns in diameters. Initial studies of alloy X2095 includes electrochemical characterization of three compositional variations each at three temperatures. The role of T(sub 1) dissolution in SCC behavior is addressed using techniques similar to those used in the research of 2090 described. SCC susceptibility is also studied using alternate immersion facilities at Reynolds Metals Corporation. Pitting is investigated in terms of stability, role of precipitate phases and constituent particles, and as initiation sites for SCC. In all research endeavors, attempts are made to link electrochemistry to microstructure. Previous work on 2090 provides a convenient basis for comparison since both alloys contain T(sub 1) precipitates but with different distributions. In 2090 T(sub 1) forms preferentially on subgrain boundaries whereas in X2095 the microstructure appears to be more homogeneous with finer T(sub 1) particles. Another point for comparison is the delta prime strengthening phase found in 2090 but absent in X2095. Author

N91-27291*# Virginia Univ., Charlottesville.

THE EFFECT OF ZINC ADDITIONS ON THE ENVIRONMENTAL STABILITY OF ALLOY 8090 (Al-Li-Cu-Mg-Zr)

Raymond J. Kilmer and G. E. Stoner *In its* NASA-UVA Light Aerospace Alloy and Structures Technology Program (LA2ST) 30 Jun. 1991 p 149-172 (For primary document see N91-27285 19-26)

Avail: NTIS HC/MF A15 CSCL 11F

Stress corrosion cracking (SCC) remains a problem in both Al-Li and conventional Al heat treatable alloys. It has recently been found that relatively small additions (less than or approximately 1 wt-percent) of Zn can dramatically improve the SCC performance of alloy 8090 (Al-Li-Cu-Mg-Zr). Constant load time to failure experiments using cylindrical tensile samples loaded between 30 and 85 percent of TYS indicate improvements of orders of magnitude over the baseline 8090 for the Zn-containing alloys under certain aging conditions. However, the toughnesses of the alloys were noticeably degraded due to the formation of second phase particles which primarily reside on grain and subgrain boundaries. EDS revealed that these intermetallic particles were Cu and Zn rich. The particles were present in the T3 condition and were not found to be the result of quench rate, though their size and distribution were. At 5 hours at 160 C, the alloys displayed the greatest susceptibility to SCC but by 20 hours at 160 C the alloys demonstrated markedly improved TTF lifetimes. Aging past this time did not provide separable TTF results, however, the alloy toughnesses continued to worsen. Initial examination of the alloys microstructures at 5 and 20 hours indicated some changes most notably the S' and delta' distributions. A possible model by which this may occur will be explored. Polarization experiments indicated a change in the trend of E(sub BR) and passive current density at peak aging as compared to the baseline 8090. Initial pitting experiments indicated that the primary pitting mechanism in chloride environments is one occurring at constituent (Al-Fe-Cu) particles and that the Cu and Zn rich boundary precipitates posses a breakaway potential similar to that of the matrix acting neither anodic or cathodic in the first set of aerated 3.5 w/o NaCl experiments. Future work will focus on the identification of the second phase particles, evaluation of K(sub 1SCC) and plateau da/dt via both DCB and slow strain rate techniques. A lower Zn content variant will be examined in the near future in hopes of optimizing toughness, density and SCC performance. Author

N91-27292*# Virginia Univ., Charlottesville. Dept. of Materials Science.

HYDROGEN INTERACTIONS IN ALUMINUM-LITHIUM ALLOYS

S. W. Smith and J. R. Scully *In its* NASA-UVA Light Aerospace Alloy and Structures Technology Program (LA2ST) 30 Jun. 1991 p 173-197 (For primary document see N91-27285 19-26)

Avail: NTIS HC/MF A15 CSCL 11F

A program is described which seeks to develop an understanding of the effects of dissolved and trapped hydrogen on the mechanical properties of selected Al-Li-Cu-X alloys. A proposal is made to distinguish hydrogen (H2) induced EAC from aqueous dissolution controlled EAC, to correlate H2 induced EAC with mobile and trapped concentrations, and to identify significant trap sites and hydride phases (if any) through use of model alloys and phases. A literature review shows three experimental factors which have impeded progress in the area of H2 EAC for this class of alloys. These are as listed: (1) inter-subgranular fracture in Al-Li alloys when tested in the S-T orientation in air or vacuum make it difficult to readily detect H2 induced fracture based on straight forward changes in fractography; (2) the inherently low H2 diffusivity and solubility in Al alloys is further compounded by a native oxide which acts as a H2 permeation barrier; and (3) H2 effects are masked by dissolution assisted processes when mechanical testing is performed in aqueous solutions. Author

N91-27293*# Virginia Univ., Charlottesville.

INVESTIGATION OF THE EFFECT OF THERMAL EXPOSURE ON THE MECHANICAL PROPERTIES OF TITANIUM/SiC COMPOSITES

Douglas B. Gundel and F. E. Wawner *In its* NASA-UVA Light Aerospace Alloy and Structures Technology Program (LA2ST) 30 Jun. 1991 p 198-217 (For primary document see N91-27285 19-26)

Avail: NTIS HC/MF A15 CSCL 11F

The objective was to evaluate the influence of thermal exposure, both isothermal and cyclic, on the reaction kinetics, mechanical properties and fracture behavior of Ti-1100 alloy/SiC fiber composites. Previously, it was determined that composites made with TiB2 coated SiC fiber (sigma) reacted at the same rate as SCS-6 fibers. As a result, the thinner surface coating on the Sigma fiber was completely consumed at shorter times than that on the SCS-6. Thermal cycling experiments were conducted on longitudinal and transverse Ti-1100/SCS-6 composites over a temperature range of 150 to 800 C for 500 cycles. The thermal exposures were carried out in air and argon. No appreciable tensile strength degradation was observed for samples cycled in argon, although a strength loss was noted for the samples cycled in air. Fracture surfaces characterization showed brittle matrix failure in regions near the surface and in regions where there was a path for O2 ingress. Author

N91-27294*# Virginia Univ., Charlottesville.

QUANTITATIVE CHARACTERIZATION OF THE SPATIAL DISTRIBUTION OF PARTICLES IN MATERIALS: APPLICATION TO MATERIALS PROCESSING

Joseph B. Parse and J. A. Wert *In its* NASA-UVA Light Aerospace Alloy and Structures Technology Program (LA2ST) 30 Jun. 1991 p 218-231 (For primary document see N91-27285 19-26)

Avail: NTIS HC/MF A15 CSCL 11F

Inhomogeneities in the spatial distribution of second phase particles in engineering materials are known to affect certain mechanical properties. Progress in this area has been hampered

by the lack of a convenient method for quantitative description of the spatial distribution of the second phase. This study intends to develop a broadly applicable method for the quantitative analysis and description of the spatial distribution of second phase particles. The method was designed to operate on a desktop computer. The Dirichlet tessellation technique (geometrical method for dividing an area containing an array of points into a set of polygons uniquely associated with the individual particles) was selected as the basis of an analysis technique implemented on a PC. This technique is being applied to the production of Al sheet by PM processing methods; vacuum hot pressing, forging, and rolling. The effect of varying hot working parameters on the spatial distribution of aluminum oxide particles in consolidated sheet is being studied. Changes in distributions of properties such as through-thickness near-neighbor distance correlate with hot-working reduction.

Author

N91-27295*# Virginia Univ., Charlottesville.
INELASTIC RESPONSE OF METAL MATRIX COMPOSITES UNDER BIAXIAL LOADING
C. J. Lissenden, F. Mirzadeh, M.-J. Pindera, and C. T. Herakovich *In its* NASA-UVA Light Aerospace Alloy and Structures Technology Program (LA2ST) 30 Jun. 1991 p 232-266 (For primary document see N91-27285 19-26)
Avail: NTIS HC/MF A15 CSCL 11F

Theoretical predictions and experimental results were obtained for inelastic response of unidirectional and angle ply composite tubes subjected to axial and torsional loading. The composite material consist of silicon carbide fibers in a titanium alloy matrix. This material is known to be susceptible to fiber matrix interfacial damage. A method to distinguish between matrix yielding and fiber matrix interfacial damage is suggested. Biaxial tests were conducted on the two different layup configurations using an MTS Axial/Torsional load frame with a PC based data acquisition system. The experimentally determined elastic moduli of the SiC/Ti system are compared with those predicted by a micromechanics model. The test results indicate that fiber matrix interfacial damage occurs at relatively low load levels and is a local phenomenon. The micromechanics model used is the method of cells originally proposed by Aboudi. Finite element models using the ABACUS finite element program were used to study end effects and fixture specimen interactions. The results to date have shown good correlation between theory and experiment for response prior to damage initiation.

Author

N91-27296*# Virginia Univ., Charlottesville. Dept. of Mechanical and Aerospace Engineering.
DESIGN OF CRYOGENIC TANKS FOR SPACE VEHICLES SHELL STRUCTURES ANALYTICAL MODELING
Charles Copper, K. McCarthy, W. D. Pilkey, and J. K. Haviland *In its* NASA-UVA Light Aerospace Alloy and Structures Technology Program (LA2ST) 30 Jun. 1991 p 267-282 (For primary document see N91-27285 19-26)
Avail: NTIS HC/MF A15 CSCL 11F

The initial objective was to study the use of superplastically formed corrugated hat section stringers and frames in place of integrally machined stringers over separate frames for the tanks of large launch vehicles subjected to high buckling loads. The ALS was used as an example. The objective of the follow-on project was to study methods of designing shell structures subjected to severe combinations of structural loads and thermal gradients, with emphasis on new combinations of structural arrangements and materials. Typical applications would be to fuselage sections of high speed civil transports and to cryogenic tanks on the National Aerospace Plane.

Author

N91-27297*# Virginia Univ., Charlottesville.
EXPERIMENTAL STUDY OF THE VISCOPLASTIC RESPONSE OF HIGH TEMPERATURE STRUCTURES
Marshall F. Coyle and E. A. Thornton *In its* NASA-UVA Light Aerospace Alloy and Structures Technology Program (LA2ST) 30 Jun. 1991 p 283-325 (For primary document see N91-27285 19-26)
Avail: NTIS HC/MF A15 CSCL 11F

Computational and experimental studies of the thermal structural behavior of thin panels subjected to localized heating are described. Three research tasks are described: (1) development of a finite element thermoviscoplastic computational approach; (2) experimental determination of material parameters for Bodner-Partom constitutive models of panel materials; and (3) experimental study of 'Heldenfels' panels subjected to intense local heating. Recent progress in each task is reviewed. Development of a new experimental set-up for the panel tests is described in detail and preliminary test results are presented.

Author

N91-27298# Joint Publications Research Service, Arlington, VA.
JPRS REPORT: SCIENCE AND TECHNOLOGY. USSR: MATERIALS SCIENCE
1 May 1990 42 p Transl. into ENGLISH from various Russian articles
(JPRS-UMS-90-003) Avail: NTIS HC/MF A03

Abstracts of Soviet literature in various areas of the materials science are compiled. The following subject areas are covered: coatings, ferrous metals, preparations, and miscellaneous. For individual titles, see N91-27299 through N91-27300.

N91-27299# Joint Publications Research Service, Arlington, VA.
LASER ALLOYING OF STEEL USING POWDER MATERIALS
S. A. Astapchik, V. S. Golubev, O. V. Novikova, L. I. Protskevich, and I. S. Chebotko *In its* JPRS Report: Science and Technology. USSR: Materials Science 1 May 1990 p 1-8 Transl. into ENGLISH from Izvestiya Akademii Nauk Belorusskoy SSR: Seriya Fiziko-Tekhnicheskikh Nauk (Minsk, USSR), No. 4, Oct.-Dec. 1989 p 7-13 (For primary document see N91-27298 19-26)
Avail: NTIS HC/MF A03

The possibility of laser alloying of the surface of steels 45, 5KhNM, and Kh12F1 in order to increase their heat stability and wear resistance is examined. Both annealed samples and samples subjected to a standard hardening heat treatment beforehand were used. Samples covered by an alcohol-based coating were irradiated by a 1 kW CO2-laser in an atmosphere of various gases, i.e., argon, nitrogen, and air. Under given experimental conditions, the following materials were used as powder coatings: pure metals and non-metals, prepared chemical compounds, i.e., carbides, borides, silicides, nitrides, and oxides, as well as certain mechanical mixtures which enter into a reaction during the heating. Following their treatment with lasers, samples were subsequently annealed at 200 to 700 C for 4 hours. Surface layers were examined by means of durometer analysis, optimal microscopy, and X-ray phase analysis. The surface roughness and the layers' wear resistance were estimated.

Author

N91-27300# Joint Publications Research Service, Arlington, VA.
HARDENING OF VT23 TITANIUM ALLOY WITH ORTHORHOMBIC MARTENSITE STRUCTURE DURING RAPID HEATING
V. V. Ivashko and N. I. Krino *In its* JPRS Report: Science and Technology. USSR: Materials Science 1 May 1990 p 9-14 Transl. into ENGLISH from Izvestiya Akademii Nauk Belorusskoy SSR: Seriya Fiziko-Tekhnicheskikh Nauk (Minsk, USSR), No. 4, Oct.-Dec. 1989 p 26-30 (For primary document see N91-27298 19-26)
Avail: NTIS HC/MF A03

The main objective was to examine the effect of the initial structural state of alpha''-martensite and the rate of subsequent heating on the efficacy of electrical and thermal hardening of titanium alloys with an alpha''-martensite structure as well as the related phase and structural transformations. Samples cut from VT23 alloy sheets were examined. Sheets were obtained by rolling at (alpha + beta)-phase temperatures. After the rolling, the sheets were annealed at 750 C. The samples were cut from the sheets in a direction perpendicular to the rolling direction and were heated to 950 and 1100 C. In order to attain bulk hardening, the quenched samples were heated again to 100 to 800 C, s well as in a furnace during 0.5 and 6 hours, then cooled in water. The structure

and phase composition were examined by electron microscopy and X-ray analysis methods. Tensile tests were carried out.
Author

N91-27301# Joint Publications Research Service, Arlington, VA.
JPRS REPORT: SCIENCE AND TECHNOLOGY. USSR: MATERIALS SCIENCE
19 Jul. 1991 33 p Transl. into ENGLISH from various Russian articles
(JPRS-UMS-91-007) Avail: NTIS HC/MF A03

Abstracts on U.S.S.R. research in materials science are given. Topics covered include ferrous metals, nonferrous metals, alloys, brazes, solders, nonmetallic materials, welding, brazing, soldering, and manufacturing processes. Author

N91-27302# Joint Publications Research Service, Arlington, VA.
JPRS REPORT: SCIENCE AND TECHNOLOGY. USSR: MATERIALS SCIENCE
24 Dec. 1990 37 p Transl. into ENGLISH from various Russian articles
(JPRS-UMS-90-006) Avail: NTIS HC/MF A03

This is a compilation of translated articles from Russian publications. They are divided into general classifications as follows: Composite Materials; Corrosion; Nonferrous metals, alloys, brazes, solders; Nonmetallic materials; Preparations; and Treatments. A representative title from each category is as follows: Multipurpose optimization of elastic and heat physical properties of fiber composites; Effect of vacuum heat treatment practice on corrosion resistance of alloy 06KhN28MDT centrifugally cast tubes; Heat treatment of VT22 titanium alloy; Characteristics of joint formation during diffusion welding of corundum ceramic with aluminum; Electrochemical synthesis of selenium hydride; and Combined use of laser processing and surface plastic deformation after electric spark alloying of steel with chromium. E.R.

N91-27303# Joint Publications Research Service, Arlington, VA.
JPRS REPORT: SCIENCE AND TECHNOLOGY. USSR: MATERIALS SCIENCE
10 Jun. 1991 50 p Transl. into ENGLISH from various Russian articles
(JPRS-UMS-91-006) Avail: NTIS HC/MF A03

Abstracts of U.S.S.R. research in materials science are given. Topics covered include coatings, corrosion, ferrous metals, nonferrous metals, alloys, brazes, solders, nonmetallic materials, and manufacturing processes. Author

N91-27304# Joint Publications Research Service, Arlington, VA.
JPRS REPORT: SCIENCE AND TECHNOLOGY. USSR: MATERIALS SCIENCE
12 Jun. 1991 52 p Transl. into ENGLISH from various Russian articles
(JPRS-UMS-91-005) Avail: NTIS HC/MF A04

Abstracts are given on U.S.S.R. research in materials science. Topics covered include nonferrous metals, alloys, brazes, solders, nonmetallic materials, welding, brazing, soldering, and manufacturing processes. Author

N91-27305# Joint Publications Research Service, Arlington, VA.
JPRS REPORT: SCIENCE AND TECHNOLOGY. USSR: MATERIALS SCIENCE
30 Apr. 1991 43 p Transl. into ENGLISH from various Russian articles
(JPRS-UMS-91-004) Avail: NTIS HC/MF A03

Abstracts of U.S.S.R. research in materials science are given. Topics covered include analysis and testing, composite materials, ferrous metals, welding, brazing, soldering, and heat treatment.
Author

N91-27306# Joint Publications Research Service, Arlington, VA.
JPRS REPORT: SCIENCE AND TECHNOLOGY. USSR: MATERIALS SCIENCE
20 Feb. 1991 33 p Transl. into ENGLISH from various Russian articles
(JPRS-UMS-91-002) Avail: NTIS HC/MF A03

Abstracts on U.S.S.R. research in materials science are given. Topics covered include composite materials, nonferrous metals, alloys, brazes, solders, nonmetallic materials, coatings, lubrication, and manufacturing processes. Author

N91-27307# Joint Publications Research Service, Arlington, VA.
JPRS REPORT: SCIENCE AND TECHNOLOGY. USSR: MATERIALS SCIENCE
31 Aug. 1990 31 p Transl. into ENGLISH from various Russian articles
(JPRS-UMS-90-004) Avail: NTIS HC/MF A03

Topics relative to U.S.S.R. research in materials science are discussed. Topics covered include corrosion cracking of steels, properties of high-cleanness high strength steel, a microfactographic study of high-speed steel produced from powder, crystal-chemical principles in control of texture formation in titanium alloy, and ensuring the efficiency of heavy, one-of-the-kind die forging equipment. For individual titles, see N91-27308 through N91-27311.

N91-27308# Joint Publications Research Service, Arlington, VA.
CORROSION CRACKING OF STEELS 03Kh20N18M2D2, 06KhN28MDT UNDER EFFECT OF PLASTIC DEFORMATION
G. Sh. Kobulashvili and L. F. Tavadze *In its* JPRS Report: Science and Technology. USSR: Materials Science 31 Aug. 1990 p 1-3 Transl. into ENGLISH from Soobshcheniya Akademii Nauk Gruzinskoy SSR (Tbilisi, USSR), v. 136, no. 2, Nov. 1989 p 393-396 (For primary document see N91-27307 19-26)
Avail: NTIS HC/MF A03

In developing structural materials intended for manufacturing production equipment which operates in corrosive media, one must establish steel's tendency to such dangerous types of corrosion as intercrystalline, pitting, and stress corrosion in addition to examining its corrosion resistance. Here, researchers examine the propensity of chrome-nickel austenite steel 03Kh20N18M2D2 to corrosion cracking; this steel was developed for fluorine-and sulfuric acid- containing highly corrosive media to replace high-alloy acid resisting steel 06KhN28MDT. In order to estimate the corrosive failure of the new steel under plastic straining in a 42 percent MgCl2 solution, alloy 06KhN28MDT was also tested at the same time. These steels' tendency to corrosion cracking was determined using the most rigid method-tests at a constant straining rate where the sample's straining rate is one of the principal parameters affecting corrosion cracking. Tests were carried out at a constant straining rate in AIMA-5--2 testers intended for long-term strength and creep tests. In order to expand the sample straining rate range, special reduction systems were developed for AIMA-5--2 testers; these systems made it possible to vary the active grip travel speed within a broad range from 10-6 to 10-9 m/s. In order to conduct the tests under conditions which reproduce equipment operating conditions in high-temperature chloride-containing media, special chambers were developed, making it possible to conduct tests in a 42 percent MgCl2 solution at 154 C. The strain diagrams (load/elongation) were recorded during the tests. The results of comparative tests of steels 06KhN28MDT and 03Kh20N18M2D2 to examine their tendency to corrosion cracking at a constant straining rate are summarized in tabular form. Author

N91-27309# Joint Publications Research Service, Arlington, VA.
PROPERTIES OF HIGH-CLEANNESS HIGH-STRENGTH STEEL 12GN2MFAYu
L. I. Mikhoduy, M. B. Movchan, V. D. Poznyakov, G. N. Strizhius, and Ye. O. Paton *In its* JPRS Report: Science and Technology. USSR: Materials Science 31 Aug. 1990 p 4-12 Transl. into ENGLISH from Problemy Spetsialnoy Elektrometallurgii (Kiev, USSR), no. 1, Jan. - Mar. 1990 p 99-106 (For primary document see N91-27307 19-26)
Avail: NTIS HC/MF A03

The objective here is to study the effect of the amount of harmful impurities on the resistance of high strength steel 12GN2MFAYu (VS-1) to delayed and brittle failure. Open hearth steel VS-1 without additional refining (control specimens) and after argon blasting (VS-1U) and electroslag remelting (steel VS-1-Sh)

was selected for this research. It was concluded that refining steel 12G2NMFAYu by electroslag remelting and blasting the metal with argon promotes a beneficial ratio among typical NI morphological groups; a reduction in the specific percentage of sulfides, oxides, and silicates and an increase in the specific percentage of oxysulfides. This narrows the range of inclusion size distribution. Increasing the cleanness of steel 12GN2MFAYu by argon blasting shifts the maximum on the austenite grain size distribution frequency curve toward lower values, i.e., it helps increase austenite grain structure uniformity. The change in the quantity of NI and the austenite grain structure increases the ductility and impact strength of steel 12G2MFAYu after refining. Reducing the overall contamination by nonmetal inclusions makes it possible to increase the cold resistance of high-strength steel 12GN2MFAYu used in static and impact loading at a temperature to -70 C. An increase in the content of diffusive hydrogen because of its localization in the discontinuites in loose multiphase oxysulfide inclusions and an increase in the welded joint cooling rate above permissible levels helps increase the tendency of the HAZ metal in highly clean high-strength steel 12GN2MFAYu to delay failure. Author

N91-27310# Joint Publications Research Service, Arlington, VA.
MICROFRACTOGRAPHIC STUDY OF HIGH-SPEED STEEL PRODUCED FROM POWDER
I. K. Kupalova, Ye. P. Kalinushkin, and V. L. Shtark *In its* JPRS Report: Science and Technology. USSR: Materials Science 31 Aug. 1990 p 13-18 Transl. into ENGLISH from Izvestiya Akademii Nauk SSSR: Seriya Metally No. 2 (Moscow, USSR), Mar. - Apr. 1989 p 129-133 (For primary document see N91-27307 19-26)
Avail: NTIS HC/MF A03

Discussed here is a comparative investigation of the microstructure of fractures, i.e., the nature of propagation of cracks, in impact testing of unnotched specimens of high-speed type R6M5F3-MP powder steel and high-speed steel type R6M5-OMSP produced by usual metallurgical method after hardening from 1190 to 1280 C and optimal tempering at 560 C, 3 times of 1 hour each, on a type ZSM-35 scanning electron microscope. As a result of studying the microstructure and related fracture surface, it was demonstrated that good operational reliability of tools made of high-speed powder steel type R6M5F3-MP can be achieved due to the specifics of the microstructure of the steel, including absence of anisotropy of austenite grain shape, manifested upon fracture as equiaxial cup fracture, with no fiber or texturing of the fracture, no rough banding, as is characteristic for the fracture of R6M5 steel made by traditional metallurgical method. Author

N91-27311# Joint Publications Research Service, Arlington, VA.
CRYSTAL-CHEMICAL PRINCIPLES IN CONTROL OF TEXTURE FORMATION IN TITANIUM ALLOY
A. A. Babareko *In its* JPRS Report: Science and Technology. USSR: Materials Science 31 Aug. 1990 p 19-24 Transl. into ENGLISH from Izvestiya Akademii Nauk SSSR: Seriya Metally No. 2 (Moscow, USSR), Mar. - Apr. 1989 p 137-140 (For primary document see N91-27307 19-26)
Avail: NTIS HC/MF A03

The development of the plane deformation texture in titanium alpha alloys depends on the degree of alloying with elements which stabilized the alpha phase and the deformation temperature. Formation of the basic texture, yielding the maximum normal anisotropy of the material, is stimulated by increasing the degree of alloying and increasing the alpha-phase deformation temperature. The relationship of plane deformation texture components in the beta-phase of titanium is determined by the degree of its alloying with elements which stabilize this phase. In titanium pseudo-beta alloys, an octahedral plane deformation texture is formed, whereas in pseudo-alpha alloys deformed in the area of temperatures where the beta phase exists the (001) (110) texture is formed and for alpha plus beta alloys developed of a mixed-type beta-phase texture is characteristic. Upon deformation of pseudo-alpha and alpha plus beta titanium alloys in the temperature area between M sub d (n) and A sub d (n) a single-version beta yields alpha phase-transition texture is formed. The development of a prismatic (1120) (1100) component in this texture is clearer, the more perfect the beta-phase of the alloy the (001) (110) texture is. For alloys of these classes deformed at temperatures above the transition temperature T sub t, it is characteristic that a multivariant phase transition alpha-phase texture develops with pyramidal and prismatic components, while for deformation at temperatures below A sub d (n) the texture of deformation of the alpha-phase develops. Author

N91-27312# Pennsylvania State Univ., University Park. Dept. of Materials Science and Engineering.
MICROSTRUCTURAL INVESTIGATIONS OF RAPIDLY SOLIDIFIED Cu-Nb ALLOY POWDERS PRODUCED BY INERT GAS ATOMIZATION
K. L. Zeik, I. E. Anderson, D. A. Koss, and P. R. Howell 30 Apr. 1991 17 p Prepared in cooperation with Iowa State Univ., Ames
(Contract N00014-91-J-1414)
(AD-A235428; TR-1) Avail: NTIS HC/MF A03 CSCL 11/6

A metallographic technique is studied which enables the microstructural examination of the cross-sections of individual, fine-scale (10 to 75 microns) powder particles. The technique was developed to permit characterization of the 'as-solidified' features of Cu-based powders produced by high pressure inert gas atomization in order to relate the microstructures to processing history. In order to perform the necessary microscopy to elucidate the microstructural features, a metallographic technique was developed to permit characterization of the 'as-atomized' microstructures within the individual powder particles. This technique involved classifying, mounting, and polishing through the diameters of individual powder particles and then using an 'attack etch' to remove some of the copper matrix. This enabled characterization of the niobium-rich second phase. Secondary electron imaging on a scanning electron microscope provided the necessary resolution to characterize the second phase morphologies as a function powder-particle size, ultimately relating the microstructures to processing conditions. GRA

N91-27313# SRI International Corp., Menlo Park, CA.
MODELING OF MICROSTRUCTURAL EFFECTS ON FRACTURE PROCESSES AT HIGH LOADING RATES Annual Report, No. 2, 1 Mar. 1990 - 28 Feb. 1991
Jacques H. Giovanola, Richard W. Klopp, and Donald A. Shockey Mar. 1991 26 p
(Contract F49620-89-K-0003)
(AD-A235431; AFOSR-91-0384TR) Avail: NTIS HC/MF A03 CSCL 11/6

The development of engineered two-phase alloys with tailored mechanical properties requires understanding of the influence of individual phases on properties. For applications involving high loading rates, understanding the rate dependence of mechanical properties is also important. To further this understanding, SRI International is studying: (1) the role of microstructure in controlling the static and dynamic fracture properties of the near-beta titanium alloy, Ti-10V-2Fe-3Al; and (2) the role of small compositional and processing differences on the dynamic deformation and fracture behavior of two high-strength steels, 300M and D-6ac steel. During a three-year program, we are performing: (1) static and dynamic fracture experiments on two types of Ti-10V-2Fe-3Al (as-quenched microstructures and those with different grain sizes) to investigate the influence of stress-induced phase transformation and grain size on fracture behavior; and (2) dynamic fracture and torsion Hopkinson bar experiments on 300M and D-6ac steel to establish differences in their dynamic stress-strain and fracture properties. We are also identifying the microfailure mechanisms in these alloys by using advanced fractographic techniques, then developing models of the observed microfailures. GRA

N91-27314# National Inst. of Standards and Technology, Gaithersburg, MD. Metallurgy Div.
THERMODYNAMIC AND KINETIC STABILITY OF REFRACTORY MATERIALS AT ULTRA-HIGH TEMPERATURES Annual Report, 1 Oct. 1989 - 30 Sep. 1990
J. W. Hastie, P. K. Schenck, and D. W. Bonnell Nov. 1990

31 p
(Grant AF-AFOSR-ISSA-90-0026; AF Proj. 2306)
(AD-A235490; AFOSR-91-0447TR) Avail: NTIS HC/MF A03
CSCL 11/2

Using the newly developed measurement technique of Laser Vaporization Mass Spectrometry (LVMS), new vapor pressure data for hafnium oxide and alpha silicon carbide at ultra high temperature have been obtained. The technique uses pulsed lasers to heat a surface on the timescale of 15 ns, providing an effectively containerless environment. Time-resolved mass spectra establish that the vaporization process is occurring under at least local equilibrium conditions. The vapor pressure data are compared with extrapolations from the literature. The agreement for HfO2 is excellent, while the comparison for SiC indicates a significant discrepancy. Both instrumental and physico-chemical influences affecting the measurements are discussed, and the possibility of a different vaporization mechanism for SiC under vacuum vaporization conditions is suggested. Preliminary optical spectroscopic approaches, to supplement the current indirect methods, to the direct measurement of surface temperatures under short pulse laser heating conditions are presented. GRA

N91-27315# Florida Univ., Gainesville. Dept. of Chemistry.
IONIZATION POTENTIALS AND REACTIVITY OF COINAGE METAL CLUSTERS Technical Report No. 35, May 1990 - Apr. 1991
M. A. Cheeseman and J. R. Eyler 10 May 1991 30 p
(Contract N00014-87-J-1248)
(AD-A235573) Avail: NTIS HC/MF A03 CSCL 11/6

The ionization potentials of several homoatomic and heteroatomic coinage metal clusters have been determined utilizing charge transfer bracketing and Fourier transform ion cyclotron resonance (FTICR) mass spectrometry. The clusters studied were Ag(n), Au(n), Cu(m), and Ag(k)Cu1, where n = 2, 3, and 5, m = 2 or 3, and k and l = 1 or 2. Atomic ionization potentials were also verified for each of the above metals as a test of the overall bracketing method. This work represents one of the first measurements of adiabatic ionization potentials for any of the above clusters. A number of additional reactions were observed between several of the charge transfer agents and metal cluster ions, including some which resulted in metal-metal bond cleavage. GRA

N91-27316# Puerto Rico Univ., Rio Piedras. Dept. of Physics.
A MODEL FOR SEQUENTIAL FIRST ORDER PHASE TRANSITIONS OCCURRING IN THE UNDERPOTENTIAL DEPOSITION OF METALS
Dale A. Huckaby and L. Blum 29 Apr. 1991 14 p
(Contract N00014-90-J-1263)
(AD-A235623; TR-8) Avail: NTIS HC/MF A03 CSCL 11/6

A model for the underpotential deposition of metals that occurs in stages is introduced. In this model the deposition takes place as a sequence of first order phase transitions of the adsorbate. In this application we study the underpotential deposition of Cu on a Au(III) surface in the presence of sulfate ions. The voltammogram of the deposition shows two sharp spikes which are reproduced by our model. GRA

N91-27317# David Taylor Research Center, Bethesda, MD. Ship Materials Engineering Dept.
FRACTURE BEHAVIOR OF ULTRA-LOW-CARBON STEEL PLATE AND HEAT-AFFECTED-ZONE Research and Development Report
M. G. Vassilaros Dec. 1990 98 p
(AD-A235638) Avail: NTIS HC/MF A05 CSCL 11/6

This report describes research carried out to investigate the fracture of ultra-low-carbon bainitic steels. Eight materials have been evaluated using notched-bar bend tests, tensile strength tests and Charpy V-notch impact tests, which were performed over a range of temperatures from -1965 C to +1005 C. These tests measured the cleavage fracture strength and the ductility to brittleness transition temperature under impact loading. The materials evaluated had carbon levels of less than 0.03 pct, manganese level from 1 pct to 2 pct, and microalloys additions of niobium, titanium and boron. Some low alloy steels contained molybdenum and nickel. Some of the materials were subjected to simulated heat-affected-zone (HAZ) thermal cycle and other thermal-mechanical treatments. The fracture surfaces of the specimens were examined using the scanning electron microscope and energy dispersive x-ray analysis. The results of the fracture tests and analyses indicate that the cleavage fracture strength of these materials can vary from 1650 to 2300 MPa. High cleavage fracture strength may be achieved with either a polygonal ferrite or an acicular/bainitic structure, but the high cleavage fracture strength of the polygonal ferrite structure material was reduced of a simulated thermal HAZ cycle. GRA

N91-27318# Naval Research Lab., Washington, DC.
EFFECT OF RIPPLE LOAD ON STRESS-CORROSION CRACKING IN STRUCTURAL STEELS Annual Report, Oct. 1989 - Nov. 1990
P. S. Pao and R. A. Bayles Feb. 1991 19 p
(AD-A235730; NRL-PUB-190-6320) Avail: NTIS HC/MF A03
CSCL 11/6

The presence of small ripple loading can, under certain circumstances, significantly reduce time to failure and threshold stress intensity of stress corrosion cracking (SCC) of steels. A predictive framework for such ripple-loading effects (RLE) is developed from concepts and descriptors used in SCC and corrosion fatigue characterization. The proposed framework is capable of defining critical conditions required for the occurrence of RLE and predicting time-to-failure curves. The agreement between the predicted and laboratory data is excellent. SCC is a cracking process caused by the conjoint action of stress and corrodent. Conceptually, SCC will occur if a sensitive material is exposed to a corrosive environment under sufficient stress for a sufficient length of time. For a structural material which contains a crack or crack-like defect, the resistance to SCC is normally evaluated in terms of the fracture mechanics parameter, the threshold stress-intensity factor below which crack extension will not occur. Applications in the real world, however - including many in offshore platform structures, rarely involve an absolutely constant load condition, but involve the superposition of relatively small amplitude load perturbations or ripple loads. GRA

N91-27319# Centre National de la Recherche Scientifique, Vitry (France).
ELECTRODEPOSITION OF DENSE CHROMIUM COATINGS FROM MOLTEN SALT ELECTROLYTES Final Technical Report
G. Lorthioir Apr. 1991 9 p
(Contract DAJA45-87-C-0047)
(AD-A235978; R/D-5686-MS-01) Avail: NTIS HC/MF A02
CSCL 11/6

Our research has showed the feasibility by pulsed current of chromium plating on nickel, iron, 4340 alloy. All the samples had a flat surface. The morphology of the deposits was examined by electronic microscopy. All the observations confirm the compacity of coatings with a uniformity in size of crystals, the good continuity between the deposit and the matrix, the grain size, and the preferential orientation in the growth after etching of a cross section. All the trails to obtain a coating inside a nickel or 4340 alloy cylinder were always a complete check. GRA

N91-27320# Brown Univ., Providence, RI. Div. of Engineering.
SPIRAL CRACKING AROUND A STRAINED CYLINDRICAL INCLUSION IN A BRITTLE MATERIAL AND IMPLICATIONS FOR VIAS IN INTEGRATED CIRCUITS
L. B. Freund and K. S. Kim 1991 12 p
(AD-A236248) Avail: NTIS HC/MF A03 CSCL 11/4

The practice of forming paths of electrical conductivity in an insulation material by filling cylindrical holes with molten metal can result in high residual stresses when the metal cools. Residual stress is greatest near the metal-insulator interface, and stress relaxation by means of de-adhesion is possible. Another failure mode that possess greater practical difficulties is the growth of cracks along paths which spiral away from the interface into the

brittle material. Such cracks may occur singly or in pairs, and their lengths can be sufficiently great to provide links with adjacent conduction paths. Such cracks are considered from the fracture mechanics point of view. The residual stress field is relaxed by the growth of spiral cracks which are modeled as continuous distribution of dislocations. It is assumed that these cracks grow so that the stress state on the prospective fracture plane just ahead of the crack tip is purely tensile. The paths are determined by means of an incremental numerical procedure. Reliability of integrated circuits is concerned with the predictable sustained performance of some electronic function. Even though the capacity for carrying mechanical loads may not be relevant to this function, failures of devices are commonly due to mechanical effects. These failures are driven by residual stresses arising from fabrication processes, often carried out at elevated temperature and involving combinations of materials with very different thermal properties. GRA

N91-27321# Cornell Univ., Ithaca, NY. Dept. of Chemistry.
SYNTHESIS, STRUCTURE, AND PROPERTIES OF A NEW INTERMETALLIC COMPOUND, Ca7Ni4Sn13
Deborah A. Vennos, Michael E. Badding, and F. J. DiSalvo 30 May 1991 18 p
(Contract N00014-91-J-1269)
(AD-A236702; TR-11) Avail: NTIS HC/MF A03 CSCL 11/6

We have previously reported that ternary metal nitrides of the general composition Ca(x)M(y)N(z), where M is a transition metal or post transition metal, are readily prepared as polycrystalline powders by reaction of Ca3N2 and M under N2 at temperatures on the order of 100 C. When the structures are relatively simple, we have been able to determine the structures by x-ray or neutron powder diffraction. In only a few instances have we obtained single crystals. In order to prepare single crystals of materials with more complicated structures, we have been attempting to develop general methods of nitride crystal growth using molten salts or metal fluxes. GRA

N91-27322# National Inst. of Standards and Technology, Gaithersburg, MD.
COMPUTATIONAL MODELS DEVELOPED FOR THE CORROSION OF PRESTRESSING STEEL
S. T. Wu and J. R. Clifton Mar. 1991 20 p Prepared in cooperation with Air Force Office of Scientific Research, Bolling AFB, Washington, DC
(PB91-167304; NISTIR-4455) Avail: NTIS HC/MF A03 CSCL 11F

Modeling for the purpose of estimating the corrosion rates of steel in prestressed concrete are discussed. For steel in concrete, localized corrosion processes are not well understood. It is premature at present to develop a sophisticated but still incomplete mathematical model. Instead, a simplified approach is proposed for the quantitative evaluation of corrosion rates. A model was developed based upon considerations of diffusion processes and electrochemical reactions. The dominant chemical factors, such as the concentration of oxygen at the electrodes, are treated as primary variables in the differential equations. Two approaches which were frequently used to treat stress corrosion cracking are briefly described. The first approach is based on a conventional engineering approach by estimating the stress intensity factors under various environments. In the second approach, the surface energy at grain boundaries is estimated along the crack path. GRA

N91-27323# Giannotti and Associates, Inc., Annapolis, MD.
CORROSION EXPERIENCE DATA REQUIREMENTS
K. A. Stambaugh and J. C. Knecht 1991 98 p
(Contract DTCG23-86-C-20064)
(PB91-169748; SSC-348; SR-1306) Avail: NTIS HC/MF A05 CSCL 11F

A corrosion survey methodology is presented to obtain corrosion data from ships. The corrosion data will be used to develop a rational method for assessing corrosion margins. The project included a survey of ship operators. The techniques used to predict corrosion rates and to assess the strength of corroded structures are reviewed to determine data requirements. The methodology consists of a data collection procedure, with recommended instrumentation. Forms were developed for documenting the measurements. Finally, an outline of the data base was developed that includes an expert system interface for data input, analysis and retrieval. Author

N91-27324*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, OH.
PROSPECTS FOR DUCTILITY AND TOUGHNESS ENHANCEMENT OF NiAl BY DUCTILE PHASE REINFORCEMENT
R. D. Noebe, F. J. Ritzert, A. Misra, and R. Gibala (Michigan Univ., Ann Arbor.) Jul. 1991 31 p
(Grant NSF DMR-88-10058)
(NASA-TM-103796; E-6022; NAS 1.15:103796) Avail: NTIS HC/MF A03 CSCL 11F

The use of NiAl as a structural material has been hindered by the fact that this ordered intermetallic does not exhibit significant tensile ductility or toughness at room temperature. A critical review of the operative flow and fracture mechanisms in monolithic NiAl has thus established the need for ductile phase toughening in this order system. Progress in ductile phase reinforced intermetallic systems in general and specifically NiAl-based materials has been reviewed. In addition, further clarification of the primary mechanisms involved in the flow and fracture of ductile phase reinforced alloys has evolved from ongoing investigations of several model NiAl-based materials. The mechanical behavior of these model directionally-solidified alloys (Ni-30Al and Ni-30Fe-20Al) are discussed. Finally, the prospects for developing a ductile phase toughened NiAl-based alloy and the shortcomings presently inherent in these systems are analyzed. Author

N91-28115*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, AL.
A STUDY OF MICROSTRUCTURAL CHARACTERISTICS AND DIFFERENTIAL THERMAL ANALYSIS OF NI-BASED SUPERALLOYS
M. D. Aggarwal, R. B. Lal, Samuel A. Oyekenu (Alabama A & M Univ., Normal.), Richard Parr, and Stephen Gentz *In* Alabama A & M Univ., NASA-HBCU Space Science and Engineering Research Forum Proceedings 1989 p 382-38 (For primary document see N91-28063 19-99)
(Grant NAG8-076)
Avail: NTIS HC/MF A23 CSCL 11F

N91-28121*# Tuskegee Inst., AL. Materials Research Lab.
EFFECT OF GRINDING ON THE FATIGUE LIFE OF TITANIUM ALLOY (5 Al-2.5 Sn) UNDER DRY AND WET CONDITIONS
Partha Rangaswamy, Hendra Terutung, and Shaik Jeelani *In* Alabama A & M Univ., NASA-HBCU Space Science and Engineering Research Forum Proceedings 1989 p 428-44 (For primary document see N91-28063 19-99)
(Grant NAG8-68)
Avail: NTIS HC/MF A23 CSCL 11F

N91-28124*# Tuskegee Inst., AL. School of Engineering and Architecture.
LOW ENERGY SPUTTERING OF COBALT BY CESIUM IONS
A. Handoo and Pradosh K. Ray *In* Alabama A & M Univ., NASA-HBCU Space Science and Engineering Research Forum Proceedings 1989 p 471-47 (For primary document see N91-28063 19-99)
(Grant NAG8-20)
Avail: NTIS HC/MF A23 CSCL 11F

27 NONMETALLIC MATERIALS

Includes physical, chemical, and mechanical properties of plastics, elastomers, lubricants, polymers, textiles, adhesives, and ceramic materials.

For composite materials see *24 Composite Materials.*

N91-27325# Oak Ridge National Lab., TN.
THE STRUCTURE AND CHEMISTRY OF GRAIN BOUNDARIES IN CERAMIC SUPERCONDUCTORS
K. B. Alexander, R. K. Williams, D. M. Kroeger, and J. Byrnestad 1990 8 p Presented at the 2nd International Ceramic Science and Technology Congress, Orlando, 12-15 Nov. 1990
(Contract DE-AC05-84OR-21400)
(DE91-010138; CONF-901125-12) Avail: NTIS HC/MF A02

The structure of grain boundaries in YBaCuO-based materials has been examined with various electron microscopy techniques. The composition of grain boundaries in the same materials has been evaluated with both Auger electron spectroscopy and analytical electron microscopy. Segregation was observed at grain boundaries in stoichiometric 123 material, but not at grain boundaries in stoichiometric 124 material. The superconducting properties could be related to the observed segregation levels in a series of carefully prepared off-stoichiometric 123 materials and to the observed grain boundary structure in aged 123 materials. DOE

N91-27326# Institute of Gas Technology, Chicago, IL.
DETERMINATION OF FLOW-REGIME BOUNDARIES FOR COHESIVE PARTICLES
T. M. Knowlton and J. G. Findlay Mar. 1991 44 p
(Contract DE-AC22-88PC-88951)
(DE91-010541; DOE/PC-88951/T2) Avail: NTIS HC/MF A03

Cohesive powders are composed of fine particles (particles generally less than 44 microns in size). Interparticle forces are extremely large and cause clumping, sticking, and channeling when attempts are made to fluidize these powders. Although flow problems can be experienced in the transport of free-flowing solids, they pale in comparison to the problems experienced with the flow of cohesive powders. Most process designers have shied away from using cohesive powders. However, cohesive powders are often produced in processes by attrition. Recent research has shown that beneficiation of oil shale and coal is possible after grinding these materials down to the cohesive size range. The purpose of this work is to develop a hydrodynamic model capable of predicting the choking/non-choking flow regime boundary for cohesive solids. There are six tasks in this study: Preparation of a project work plan; Hydrodynamic model development; Determination of solid rheological properties for incorporation into the hydrodynamic model; Small-scale flow tests; Large-scale flow tests; and comparison of model with data and preparation of final report. Consolidation tests to determine the solids modulus of elasticity, G, for various powders were conducted: cohesive oil shale (10 microns in size), 500-micron and 40-micron glass beads, and 6-micron atomic alumina. Values of the solids viscosity were calculated from experimental data obtained in the small-scale rise test unit for FCC catalyst. Work was started on modifying the 30-cm-diameter test unit. This unit will be used to obtain large-scale data on cohesive solids in dilute-phase flow. DOE

N91-27327# Argonne National Lab., IL.
STRUCTURE AND STRUCTURAL DIVERSITY IN RESINITES AS DETERMINED BY PYROLYSIS-GAS CHROMATOGRAPHY-MASS SPECTROMETRY
K. B. Anderson and R. E. Winans 1991 10 p Presented at the 201st American Chemical Society (ACS) National Meeting, Atlanta, 14-19 Apr. 1991
(Contract W-31-109-eng-38)
(DE91-010798; ANL/CP-72270; CONF-910402-10) Avail: NTIS HC/MF A02

Pyrolysis-gas chromatography-mass spectroscopy (Py-GC-MS) is a useful technique for the rapid characterization of resinites, especially when used in conjunction with in-situ methylation procedures, which permit chromatographic analysis of acidic components without complex sample preparation. Although significant diversity exists in resinite structures, the majority of resinites may be classified into one of three basic structural groups. Resinites from the largest and most important of these may be further subdivided on the basis of specific structural characteristics into three subclasses. Within these classes, details of specific composition may vary significantly between samples as a consequence of differences in botanical origin and/or level of maturation, but sufficient common structural characteristics exist within these classes to validate application of such a classification system. DOE

N91-27328*# State Univ. of New York, Buffalo. Dept. of Chemical Engineering.
SYNTHESIS OF HIGH PERFORMANCE CERAMIC FIBERS BY CHEMICAL VAPOR DEPOSITION FOR ADVANCED METALLICS REINFORCING Final Technical Report, 1988 - 1991
Vithal Revankar and Vladimir Hlavacek May 1991 167 p
(Grant NAG3-897)
(NASA-CR-185384; NAS 1.26:185384) Avail: NTIS HC/MF A08 CSCL 11C

The chemical vapor deposition (CVD) synthesis of fibers capable of effectively reinforcing intermetallic matrices at elevated temperatures which can be used for potential applications in high temperature composite materials is described. This process was used due to its advantage over other fiber synthesis processes. It is extremely important to produce these fibers with good reproducible and controlled growth rates. However, the complex interplay of mass and energy transfer, blended with the fluid dynamics makes this a formidable task. The design and development of CVD reactor assembly and system to synthesize TiB2, CrB, B4C, and TiC fibers was performed. Residual thermal analysis for estimating stresses arising form thermal expansion mismatch were determined. Various techniques to improve the mechanical properties were also performed. Various techniques for improving the fiber properties were elaborated. The crystal structure and its orientation for TiB2 fiber is discussed. An overall view of the CVD process to develop CrB2, TiB2, and other high performance ceramic fibers is presented. Author

N91-27329*# Lockheed Engineering and Sciences Co., Hampton, VA.
AN IMPROVED COMPRESSION MOLDING TECHNOLOGY FOR CONTINUOUS FIBER REINFORCED COMPOSITE LAMINATE. PART 1: AS-4/LaRC-TPI 1500 (HFG) PREPREG SYSTEM
Tan-Hung Hou, Paul W. Kidder, and Rakasi M. Reddy May 1991 32 p Prepared in cooperation with Old Dominion Univ., Norfolk, VA
(Contract NAS1-19000; NAG1-569)
(NASA-CR-187572; NAS 1.26:187572) Avail: NTIS HC/MF A03 CSCL 11C

Poor processability of fiber reinforced high performance polyimide thermoplastic resin composites is a well recognized issue which, in many cases, prohibits the fabrication of composite parts with satisfactorily consolidated quality. Without modifying the resin matrix chemistry, improved compression modeling procedures were proposed and investigated with the AS-4/LaRC-TPI 1500 High Flow Grade (HFG) prepreg system. Composite panels with excellent C-scans can be consistently molded by this method under 700 F and a consolidation pressure as low as 100 psi. A mechanism for the consolidation of the composite under this improved molding technique is discussed. This mechanism reveals that a certain degree of matrix shear and tow filament slippage and nesting between plies occur during consolidation, which leads to a reduction of the consolidating pressure necessary to offset the otherwise intimate inter fiber-fiber contact and consequently achieves a better consolidation quality. Outstanding short beam shear strength and flexural strength were obtained from the molded panels. A prolonged consolidation step under low pressure, i.e., 100 psi at 700 F for 75 minutes, was found to significantly enhance the composite mechanical properties. Author

N91-27330*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, AL.
VACUUM VAPOR DEPOSITION: A SPINOFF OF SPACE WELDING DEVELOPMENT
R. M. Poorman Jun. 1991 13 p
(NASA-TM-103542; NAS 1.15:103542) Avail: NTIS HC/MF A03 CSCL 11C

A vapor deposition process has been defined through a spinoff effort of space welding development. In this development for welding in a space environment, a hollow electrode was used to add gas precisely at the welding arc. This provides gas for ionization which carries the welding arc current. During this welding development metal vapor coatings were observed. These coatings are unique in that they are produced by a new process. Some coatings produced and the potential of this new and innovative vapor deposition process are characterized. Advantages over prior art are discussed. Author

N91-27331*# College of William and Mary, Williamsburg, VA.
THE EFFECTS OF THE INTERACTION OF POLYMERIC MATERIALS WITH THE SPACE ENVIRONMENT Semiannual Status Report, 1 Jan. - 15 Jun. 1991
Richard L. Kiefer and Robert A. Orwoll 1991 28 p
(Contract NCC1-126)
(NASA-CR-188659; NAS 1.26:188659) Avail: NTIS HC/MF A03 CSCL 11C

Polymeric materials in low earth orbit will be exposed to a harmful environment mainly due to atomic oxygen and ultraviolet radiation. In geosynchronous earth orbit, the major hazards to such materials are energetic charged particles and ultraviolet radiation. The progress of studies on the effects of these hazards on a polyetherimide, a polyimide, and an epoxy adhesive is presented. Author

N91-27332*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, AL.
PROOF TEST DIAGRAMS FOR ZERODUR GLASS-CERAMIC
D. S. Tucker Jun. 1991 11 p
(NASA-TM-103543; NAS 1.15:103543) Avail: NTIS HC/MF A03 CSCL 11C

Proof test diagrams for Zerodur glass-ceramics are calculated from available fracture mechanics data. It is shown that the environment has a large effect on minimum time-to-failure as predicted by proof test diagrams. Author

N91-27333# Army Chemical Research and Development Center, Aberdeen Proving Ground, MD.
PREDICTING POLYMER PROPERTIES BY COMPUTATIONAL METHODS. PART 1: POLYVINYL CHLORIDE AND ITS HOMOLOGS Final Report, May - Jun. 1990
P. N. Krishnan, R. E. Morris, G. R. Famini, and A. Birenzvige Jan. 1991 33 p Prepared in cooperation with Coppin State College, Baltimore, MD
(DA Proj. 1C1-62622-A-553)
(AD-A235434; CRDEC-TR-254) Avail: NTIS HC/MF A03 CSCL 07/6

A semiempirical quantum mechanical approach semiempirical minimum neglect differential overlap (MNDO) Hamiltonian has been applied to predict the heat of formation, dipole moment, polarizability, and solubility of polyvinyl chloride (PVC) and several of its homologs. Some of the physical properties of long chain polymers can be estimated from the calculations, using the dimer as a model. To the best of our knowledge, this study is the first attempt to predict polymer properties from relatively small molecule properties. GRA

N91-27334# Crystallume, Menlo Park, CA.
SYNTHESIS AND CHARACTERIZATION OF SILICON-ON-DIAMOND STRUCTURES Final Report, 1 Aug. 1988 - 30 Apr. 1991
Maurice Landstrass 30 Apr. 1991 58 p
(Contract N00014-88-C-0530)
(AD-A235460) Avail: NTIS HC/MF A04 CSCL 09/1

Silicon on Diamond (SOD) is a unique silicon on insulator (SOI) structure composed of a thin single crystal silicon film on a thin insulator made of plasma synthesized diamond. The excellent electrical resistivity and unsurpassed thermal conductivity of diamond offers the opportunity for extending the performance capabilities of silicon integrated circuits. Such a structure permits the fabrication of high performance silicon semiconductor circuits characterized by high speed, low dynamic power consumption, greater packing density, increased power dissipation, and immunity from latch up and radiation induced failure. The work successfully demonstrated three issues critical to the successful use of diamond films in conjunction with silicon for SOI structures which include: (1) the growth of high resistivity CVD diamond films; (2) the optimization of the properties of the interface between single crystal silicon and polycrystalline diamond films; and (3) the measurement of the radiation hardness of SOD structures was found to be excellent. GRA

N91-27335# Minnesota Univ., Minneapolis. Dept. of Aerospace Engineering and Mechanics.
CRAZING IN POLYMERIC AND COMPOSITE SYSTEMS Final Report, 15 Mar. 1987 - 14 Mar. 1990
C. C. Hsiao 23 Apr. 1990 130 p
(Grant AF-AFOSR-0143-87; AF Proj. 2302)
(AD-A235525; AFOSR-91-0392TR) Avail: NTIS HC/MF A07

The technical report on crazing polymeric and composite systems encompasses several phases of mesomechanics studies which lead into continuum and non-continuum microdamage mechanics investigations. It is based upon the first principles of physics and mechanics and the sciences of the microstructure of materials. Ideas have been introduced in developing new theories in time dependent deformation, strength theories and damage criteria for solids and composite systems. The initiation and propagation of crazing as quasifracture, the time dependent fracture strength of oriented polymers, the associated molecular orientation and ultimate strength in and around a craze, and the interaction of crazes in polymeric and composite materials are some of the features to be understood. The determination of the time dependent fracture strength of polymers and composite systems, the displacement field and the distribution of stresses in the vicinity of craze-crack transition regions as well as the behavior of craze and crack propagation are problems to be considered. GRA

N91-27336# Army Lab. Command, Watertown, MA. Material Technology Lab.
X RAY DIFFRACTION STUDIES OF DISORDER IN ALLIED SPECTRA-1000 POLYETHYLENE FIBERS
C. R. Desper Apr. 1991 14 p
(AD-A235527; MTL-TR-91-11) Avail: NTIS HC/MF A03 CSCL 14/2

A recent paper by Busing on the x ray diffraction study of polyethylene fibers (Busing, Macromolecules, 1990, 23, 4608-4610) was reviewed and condensed. Busing describes a new and improved method for measuring and analyzing the crystal structure and pertinent morphological parameters of polyethylene in fiber form. More than a determination of structure in a particular fiber, the paper is a pointer to how crystallography may be best accomplished in semi-crystalline polymers in the future. The application of FIBLS, the full-pattern least-squares fiber-diffraction program is outlined. The results of the analysis include crystallinity, orientation function, paracrystalline disorder parameters, unit cell dimension parameters, atomic positions, bond distances, and bond angles. The most complete analysis using the difference Fourier method reveals, for the first time, three additional sites for carbon atoms in the unit cell structure, partially occupied by disordered segments of the chain bypassing their usual route in the unit cell to alternative sites. The importance of the method goes beyond polyethylene, or even beyond polymers of interest for fibers applications. GRA

N91-27337# Cincinnati Univ., OH. Dept. of Materials Science and Engineering.
CHARACTERIZATION OF INTERPHASES BETWEEN PMDA/4-BDAF POLYIMIDES AND SILVER AND GRAPHITE SUBSTRATES USING X RAY PHOTOELECTRON SPECTROSCOPY
W. H. Tsai, N. G. Cave, and F. J. Boerio 1 May 1991 52 p
(Contract N00014-89-J-1590)
(AD-A235567; TR-14) Avail: NTIS HC/MF A04 CSCL 07/3

Interfaces formed by curing the polyamic acid (PAA) of pyromellitic dianhydride (PMDA)/ 2,2-bis(4-(4- aminophenox (-phenyl) hexa fluoropropane (4-BDAF) polyimide against silver substrates were characterized by x-ray photoelectron spectroscopy (XPS). The C(ls) multiplex spectra of PAA films cured against thick silver films were more similar to those obtained before curing than to those for the bulk PMDA/4-BDAF polyimide, indicating that curing of the polymer was inhibited by interaction of the PAA with the silver substrate. This was evidenced by observing a peak shifted upward by 3.2 eV from the main carbon peak near 284.6 eV which consisted of two overlapping peaks characteristic of the amide and carboxylate groups. Moreover, the main peak observed near 400.4 eV in the N(1s) spectra was attributed to the amides. GRA

N91-27338# Florida Univ., Gainesville. Dept. of Chemistry.
FORMATION OF C10H8(+) FROM THE BENZENE RADICAL CATION: A CASE FOR THE GROWTH OF POLYCYCLIC AROMATIC HYDROCARBON IONS BY ION/MOLECULE REACTIONS IN THE GAS PHASE? Technical Report No. 33, Apr. 1989 - Oct. 1990
D. K. Bohme, S. Wlodek, J. A. Zimmerman, and J. R. Eyler 10 May 1991 21 p
(Contract N00014-87-J-1248)
(AD-A235574) Avail: NTIS HC/MF A03 CSCL 07/3

Experimental results are reported which show that diacetylene, but acetylene, adds rapidly to C6H6 in the gas phase in helium at 0.35 Torr and 296 +/- 2 K when C6H6(+) is produced by the chemical ionization of benzene with NO(+). The experiments were performed with the selected-ion flow tube (SIFT) and Fourier transform ion cyclotron resonance (FTICR) techniques. Chemical reactivity and ion photodissociation methods were employed to investigate the identity of the C10H8(+) produced by the addition reaction. Results were obtained for the reactions of this cation with deuterium, acetylene, diacetylene, styrene, trimethylamine, nitric oxide, 1,2,4,5-tetramethylbenzene and p-methylaniline, and were compared with the results of the reactions of these same molecules with the C10H8(+) radical cation produced directly from naphthalene by chemical ionization with Si(+) and electron ionization. GRA

N91-27339# Brown Univ., Providence, RI. Div. of Engineering.
THREE DIMENSIONAL ANALYSIS OF CRACK TRAPPING AND BRIDGING BY TOUGH PARTICLES Final Report
M. Ortiz Apr. 1991 66 p
(Contract N00014-85-K-0720)
(AD-A235591) Avail: NTIS HC/MF A04 CSCL 11/2

Ceramics have several properties that make them appealing materials for a wide range of practical applications. Since their strength is limited by brittle failure, the fracture of ceramics has been the subject of extensive research. However, despite recent progress in the area, a number of issues remain unresolved. For example, while the measured toughness of single crystals is comparable to their surface energy, that of polycrystalline materials is found to be up to an order of magnitude greater. In addition, the apparent toughness of the material is observed to increase with crack length. Three mechanisms were proposed that may explain this behavior: crack tip shielding by microcracking; crack deflection; and crack trapping combined with crack face bridging by tough particles. The possibility that microcracking may improve toughness has recently been the subject of intense investigation. Extensive microcracking is in fact observed around the tips of cracks in brittle polycrystalline materials. The microcracks increase the compliance of the solid, and so shield the crack tip from remote stresses. GRA

N91-27340# David Taylor Research Center, Bethesda, MD. Ship Materials Engineering Dept.
ACOUSTIC BEHAVIOR OF NEGATIVE POISSON'S RATIO MATERIALS Research and Development Report
Barbara Howell, Pat Prendergast, and Larry Hansen Mar. 1991 31 p
(AD-A235695; DTRC/SME-91/01) Avail: NTIS HC/MF A03 CSCL 11/7

Negative Poisson's ratio (NPR) materials have been predicted to have unusual acoustic properties. To measure this effect, polyurethane foam was chosen to serve as a model system. Negative Poisson's ratio materials were produced from open cell, reticulated polyurethane foams by heat setting the foam which was compressed in three dimensions to a volume smaller by the factor 3.7 than the original volume. Acoustic tests comparing the reflection properties of the unconverted, the NPR uncovered, and the NPR foam with an attached cover, and one with an unattached covering were made on foams with pore sizes ranging from 10 to 100 pores per linear inch. Uncovered NPR foams reflected less sound at all frequencies than the uncovered unconverted foam. Smaller pore size NPR foams absorbed sound more efficiently at frequencies above 630 than did those with larger pores, and those with covers were better sound absorbers in the frequency range 250 to 1000 Hz than the uncovered NPR foams. Unidirectional compression to 1/4th the original thickness reduced the Poisson's ratio to zero and caused the foam to absorb nearly as well as did creation of the negative Poisson's ratio. GRA

N91-27341# Lowell Univ., MA. Dept. of Chemistry.
MOLECULAR DESIGN OF STABLE SECOND ORDER NONLINEAR OPTICAL POLYMERS Technical Report No. 4, 1 Jun. 1990 - 31 May 1991
B. K. Mandal, S. K. Tripathy, and J. Kumar 3 May 1991 8 p
(Contract N00014-90-J-1148)
(AD-A235748; Rept-1148-04) Avail: NTIS HC/MF A02 CSCL 20/6

The temporal and thermal stability of second order nonlinear optical properties of polymers is an important issue in the development of polymeric electro-optic devices. This has been addressed by introducing interchain crosslinking. A number of crosslinked systems developed by photochemical reactions have been presented. The important parameters necessary for device fabrication in polymers are ease of processability, stable (at least upto 100 C) nonlinear susceptibility (X2) and low optical loss. Each of these factors are equally important if polymeric materials are to play a role in integrated optical devices. The processability of polymeric materials can provide significant advantages over their inorganic counterparts. Most inorganic second order nonlinear optical (NLO) materials are crystalline and good quality single crystals of reasonable dimensions have to be grown to have low optical losses. GRA

N91-27342# Lowell Univ., MA. Dept. of Chemistry.
OPTIMIZED PROCESSING CONDITION FOR A PHOTOCROSSLINKABLE STABLE NONLINEAR OPTICAL POLYMER Technical Report No. 8, 1 Jun. 1990 - 31 May 1991
J. Y. Lee, W. H. Kim, B. K. Mandal, J. Kumar, and S. K. Tripathy 3 May 1991 16 p
(Contract N00014-90-J-1148)
(AD-A235754; Rept-1148-08) Avail: NTIS HC/MF A03 CSCL 07/3

The optimum processing condition for a photocrosslinking nonlinear optical (NLO) polymeric system was established. Parameters such as change in heat capacity at glass transition temperature, rate of decrease of absorbance of residual uncrosslinked chromophores, and measurement of mass loss upon heating were used to set up the optimum condition. Polyvinyl cinnamate was used as the photocrosslinkable polymer and 3-cinnamoyloxy- 4- (4- (N,N diethylamino)- 2-cinnamoyloxy phenyl azo) nitrobenzene was used as the NLO molecule. Poling at 70 C

for 5 minutes followed by photocrosslinking with a dose of 2.5 mW/sq cm for 10 minutes results in a stable second order nonlinear optical material. GRA

N91-27343# Cornell Univ., Ithaca, NY.
PHOTOGENERATION OF REACTIVE AMINE FUNCTIONALITIES WITHIN POLYMERS: SYNTHESIS OF PHOTOPRECURSOR COPOLYMERS AND THEIR USE IN PHOTOCURING
Jody E. Beecher, James F. Cameron, and Jean M. Frechet 2 May 1991 4 p
(Contract N00014-91-J-1338)
(AD-A235847; TR-2) Avail: NTIS HC/MF A01 CSCL 07/3

The chemistry of o-nitrobenzyl substituted alcohols and acids has led to important developments in protecting group chemistry as well as polymer curing and imaging. We have now developed a new family of amines protected with photolabile groups such as the o-nitrobenzyl oxycarbonyl moiety. Reactive polymers containing protected amino groups were prepared by copolymerization of suitable monomers followed by chemical modification. In order to optimize the photodeprotection step, structurally analogous small molecule model compounds were also prepared. Irradiation of these model carbamates with UV light at 254 or 313 nm in the solid-state or in solution results in their clean deprotection to afford free amines. The reactive polymers selected for this study contained varying amount of the photoactive groups derived from p-aminostyrene with styrene or methyl methacrylate as the co-monomers. As expected, exposure of the copolymers to UV radiation below 400 nm in solution or in the solid state led to the formation of polymers with free amine pendant groups. Quantum yield measurements confirmed that the photochemical deprotection was as effective with the polymers in the solid state as with the model compounds. The reactive copolymers were tested as curing agents for a variety of epoxy coatings. GRA

N91-27344# Cornell Univ., Ithaca, NY.
THE PHOTOGENERATION OF ORGANIC BASES FROM O-NITROBENZYL DERIVED CARBAMATES
James F. Cameron and Jean M. Frechet 3 May 1991 48 p
(Contract N00014-91-J-1338)
(AD-A235848; TR-3) Avail: NTIS HC/MF A03 CSCL 07/3

The design of novel photoprecursors of organic bases and the steric and electronic factors that control their quantum efficient transformation into free amines or diamines have been investigated. The basic design involves the protection of amines with photolabile o-nitrobenzyl oxycarbonyl groups or a-substituted analogs. The resulting protected amines owe their light sensitivity to the classical o-nitrobenzyl photo-rearrangement and cleanly liberate free amine in both the solid state and in solution upon irradiation with UV light below 400 nm. Several designs were explored in which the structure of the photoactive center was varied systematically to investigate the influence of various steric and electronic effects. In all cases, the practical potential of these photoactive carbamates as organic sources of photogenerated base was evaluated by product analysis of solution photolysates, by determination of their solid state quantum efficiencies, and by measurement of their thermal properties. For example, the quantum efficiency of various carbamates for cyclohexylamine photogeneration at 254 nm ranged from 0.11 to 0.62 depending on both alpha - substituent and o-nitro substitution patterns confirming the importance of both steric and electronic considerations. Similar results were obtained with other base photoprecursors and all showed good thermal stabilities. GRA

N91-27345# Lowell Univ., MA. Dept. of Chemistry.
DESIGN AND SYNTHESIS OF A NEW CLASS OF PHOTOCROSSLINKABLE NONLINEAR OPTICAL POLYMERS Technical Report No. 23, 1 Jun. 1990 - 31 May 1991
S. K. Tripathy, B. K. Mandal, R. J. Jeng, J. Y. Lee, and J. Kumar 3 May 1991 6 p
(Contract N00014-90-J-1148)
(AD-A235852; Rept-1148-23) Avail: NTIS HC/MF A02 CSCL 07/6

A new class of photocrosslinkable polymers was developed with stable second and third order nonlinear optical (NLO) properties. The polymers have significant processing advantages over their inorganic counterparts. The NLO polymers have been designed as guest-host systems and as polymers with the NLO and photocrosslinkable units in the main chain and in the side chain. Cinnamoyl groups have been selected as photocrosslinking groups. Donor-acceptor substituted conjugated dyes functionalized with photocrosslinking units have been used as the NLO component. The stability of the poled and crosslinked polymers has been investigated by monitoring the decay of the second harmonic signal. No measurable decay in optical nonlinearity is observed for one of the photocrosslinked polymers up to temperatures of 160 C for a period of several hours. These results are also confirmed by monitoring the stability of the UV-visible absorption spectrum at these temperatures. Channel waveguides and diffraction gratings have been fabricated using lithographic techniques. GRA

N91-27346# Lowell Univ., MA. Dept. of Chemistry.
SECOND HARMONIC PROPERTIES OF AROMATIC SCHIFF'S BASES FUNCTIONALIZED IN THE SIDE CHAINS OF POLYMETHYLMETHACRYLATE Technical Report No. 12, 1 Jun. 1990 - 31 May 1991
T. Takahashi, B. K. Mandal, Y. M. Chen, J. Y. Lee, and L. Samuelson 3 May 1991 8 p
(Contract N00014-90-J-1148)
(AD-A235857; Rept-1148-12) Avail: NTIS HC/MF A02 CSCL 07/6

Polymeric thin films doped with NLO molecules are easily prepared. Recently, a number of new homo- and copolymers were reported, in which the NLO molecules separated by flexible methylene spacer are covalently attached in the side chain of polymethacrylate (PMA) backbone. Aromatic Schiff's bases substituted with appropriate donor acceptor groups have been chosen because of their high ground-state dipole moment and large molecular hyperpolarizability. The synthesis, characterization, nonlinear optical properties and preparation and characterization of mono or multilayer films of new side chain polymers are presented and discussed. GRA

N91-27347# Army Electronics Command, Fort Monmouth, NJ. Electronic Components Lab.
LANGMUIR-BLODGETT FILMS OF AROMATIC SCHIFF'S BASES FUNCTIONALIZED IN THE SIDE CHAINS OF POLYMETHACRYLATE Technical Report No. 21, 1 Jun. 1990 - 31 May 1991
T. Takahashi, P. Miller, Y. M. Chen, L. Samuelson, and D. M. Galotti 3 May 1991 32 p
(Contract N00014-90-J-1148)
(AD-A235858) Avail: NTIS HC/MF A03 CSCL 07/6

Langmuir-Blodgett (LB) film formation has been investigated for polymers in which nonlinear optical (NLO) moieties are attached in the side chain of polymethacrylate (PMA) backbone. Polymer monolayer was successfully transferred onto hydrophilic glass substrates using a moving wall type LB trough. The LB films were characterized by pressure-area isotherm, polarized UV-visible spectra, ellipsometry and second harmonic generation measurement. The characterization shows that NLO moieties in the side chain are inclined to the plane of the substrate at a shallow angle. The second order nonlinear coefficient and molecular hyperpolarizability were also calculated. GRA

N91-27348# Lowell Univ., MA. Dept. of Chemistry.
THE MONOMOLECULAR ORGANIZATION OF A PHOTODYNAMIC PROTEIN SYSTEM THROUGH SPECIFIC SURFACE RECOGNITION OF STREPTAVIDIN TO BIOTINYLATED LB FILMS Technical Report No. 18, 1 Jun. 1990 - 31 May 1991
L. A. Samuelson, P. Miller, D. M. Galotti, K. A. Marx, and J. Kumar 3 May 1991 24 p
(Contract N00014-90-J-1148)

(AD-A235859; Rept-1148-18) Avail: NTIS HC/MF A03 CSCL 07/4

This paper focuses on a methodology for the two-dimensional ordering of a photodynamic protein system using the Langmuir-Blodgett (LB) technique. The specific versus non-specific surface recognition of biotin or biotinylated LB monolayers by streptavidin and avidin conjugated phycoerthrin was investigated. Both avidin and streptavidin conjugates, when injected under the biotinylated monolayer, were found to preferentially adsorb to the biotin while at the air-water interface. Pressure-area isotherms displayed a biotin-streptavidin/avidin complex dependent increase in surface pressure at expanded areas indicating protein adsorption. Fluorescence measurements of transferred films confirmed the binding of phycoerythrin to the monolayers and provided evidence that the avidin conjugated system may bind by both specific and non-specific mechanisms, while the streptavidin systems bind through only a specific mechanism. The extension of this methodology to any biotin or avidin/streptavidin derivatized protein system is expected to lead to the fabrication of ultrathin, ordered, protein molecular assemblies with potential bioelectronic, optical and protein structure research applications. GRA

N91-27349# Lowell Univ., MA. Dept. of Chemistry.
OPTICAL CHARACTERIZATION AND PATTERNING OF NONLINEAR OPTICAL POLYMERS WITH PHOTOCROSSLINKING GROUPS Technical Report No. 22, 1 Jun. 1990 - 31 May 1991
P. Miller, J. Y. Lee, R. J. Jeng, W. H. Kim, and S. Broude 3 May 1991 31 p
(Contract N00014-90-J-1148)
(AD-A235861; Rept-1148-22) Avail: NTIS HC/MF A03 CSCL 07/6

Two photosensitive polymers have been characterized for their linear optical properties. The changes of absorbance and of the index of refraction due to UV radiation have been investigated. Holographic gratings were written in these photopolymers. The diffraction efficiencies of these holographic gratings were used to measure the index changes. It was demonstrated that an index pattern can be easily written in these two photopolymers by using a one step conventional photolithographic process. These photopolymers can exhibit large second order nonlinearities. It is expected that photolithographic patterning techniques investigated will play an important role in integrated optical device fabrication. GRA

N91-27350# Lowell Univ., MA. Dept. of Chemistry.
OPTICAL AND ELECTRO-OPTICAL PROPERTIES OF A PHOTOCROSS-LINKABLE POLYMER Technical Report, 1 Jun. 1990 - 31 May 1991
A. K. Rahman, B. K. Mandal, X. F. Zhu, J. Kumar, and S. K. Tripathy 3 May 1991 8 p
(Contract N00014-90-J-1148)
(AD-A235903; Rept-1148-01) Avail: NTIS HC/MF A02 CSCL 07/6

Planar waveguides from a photocrosslinkable polymer were fabricated on glass and SiO2 on silicon using the spin coating process. The polymer was crosslinked by exposure to UV radiation (lambda = 254 nm). Prism coupling technique was used to couple a laser beam into the waveguide structure. The waveguiding parameters such as number of modes, loss, thickness and index of refraction of the polymer were determined before and after crosslinking. The refractive index of the polymer before crosslinking differs significantly from that after crosslinking. No anisotropy was observed in the refractive indices for the uncrosslinked or crosslinked samples. The refractive index and thickness of the polymer film before and after crosslinking were also measured using an ellipsometer and found to be in very good agreement with those obtained by the prism coupling technique. Dye molecules with large second order hyperpolarizability were utilized as guests into the photocrosslinkable polymer matrix for second order nonlinear optical applications. Electro-optic properties of this polymeric system are reported. GRA

N91-27351# South Carolina Univ., Columbia. Dept. of Chemistry.
ORGANOMETALLICS FOR CONDUCTING POLYMER SYNTHESIS AND STARBURST POLYMER SYNTHESIS
James M. Tour 16 May 1991 13 p
(Contract N00014-89-J-3062)
(AD-A235933) Avail: NTIS HC/MF A03 CSCL 07/6

New synthetic organometallic reactions can be used to synthesize novel conjugated polymer systems w/interesting electronic and photonic characteristic. The first synthesis of a PI/SIGMA/PI conducting oligomer is described. It has two polythiophene backbones affixed at 90 deg angles to each other by a spiro carbon core. An unprecedented method for aryl-aryl coupling was developed which allows the facile preparation of soluble polyphenylenes. A silicon based starburst polymer synthesis was proposed. A route to planar phenylene oligomers was also proposed. Author

N91-27352# Lowell Univ., MA. Dept. of Chemistry.
A NEW APPROACH TO DESIGN OF CROSS-LINKED SECOND-ORDER NONLINEAR OPTICAL POLYMERS Technical Report No. 2, 1 Jun. 1990 - 31 May 1991
B. K. Mandal, J. Y. Lee, X. F. Zhu, Y. M. Chen, and E. Prakeenvincha 3 May 1991 10 p
(Contract N00014-90-J-1148)
(AD-A235962; Rept-1148-02) Avail: NTIS HC/MF A02 CSCL 07/6

A new class of crosslinked second-order nonlinear optical (NLO) polymers has been developed by processing a NLO-dye and a polymer similar to conventional doped polymer system. Intermolecular crosslinking was carried out by UV radiation subsequent to electric field induced poling of the composite. Cinnamate (C6H5-CH=CH-CO2-) and styrylacrylate (C6H5-CH=CH-CH=CH-CO2-) moieties are selected as the photoreactive chromophores which are attached to both the NLO molecules at two positions and randomly substituted to a vinyl polymer. The poled crosslinked polymers exhibit stable nonlinear activity over a long period of time as characterized by temporal response of second-harmonic generation signal and UV absorption characteristics. GRA

N91-27353# Case Western Reserve Univ., Cleveland, OH. Dept. of Macromolecular Science.
PROPERTIES OF ANHYDRIDE-CURED EPOXY FILLED WITH SILICA TREATED WITH SILANE BLENDS OF AMINO AND ALKYL END GROUPS
S. L. Tidrick, Hatsuo Ishida, and J. L. Koenig May 1991 38 p
(Contract N00014-88-R-0330)
(AD-A235981; CWRU/DMS/TR-39) Avail: NTIS HC/MF A03 CSCL 11/4

Cylinders made of a benzyldimethylamine (BDMA)-catalyzed, nadic methyl anhydride (NMA)-cured diglycidyl ether of bishphenol-A (BDGE) were filled with 30 weight percent of silica. The silica had previously been treated by silane blends of varying composition, of either gamma-aminopropyltriethoxysilane (APS) and butyltriethoxysilane (BTS) or APS and ethyltriethoxysilane (ETS). A variety of techniques were utilized in order to compare the effects of BTS versus ETS and the concentration of amine in the silane blend. These techniques include cross polarization magic angle spinning (CP-MAS) Silicon 29 solid state nuclear magnetic resonance (NMR), photoacoustic (PAS)-Fourier transform infrared spectroscopy (FTIR), differential scanning calorimetry (DSC), thermal gravimetric analysis (TGA), compression strength, scanning electron microscopy (SEM) of fracture surfaces, Hydrogen 1 NMR imaging, and gravimetric analysis of water sorption. The results indicate the importance of structure and composition of the silane interphase on the properties of composite materials. GRA

N91-27354# Harvard Univ., Cambridge, MA. Dept. of Chemistry.
SUPERSONIC PYROLYSIS JETS FOR DIAMOND FILM DEPOSITION Technical Report No. 1, 1 Oct. 1990 - 22 May 1991

Peter Chen 22 May 1991 11 p
(Contract N00014-91-J-1012)
(AD-A236035) Avail: NTIS HC/MF A03 CSCL 07/4

Recent progress in the production of high-intensity supersonic free jets of hydrocarbon radicals (e.g., CH2Hn, C3Hn), has made it possible to investigate the growth mechanism of diamond and diamond-like carbon by bombardment of a substrate with a well-characterized supersonic flow of defined radicals. This report details the first phase of the project, encompassing source design, and the engineering of specific radical precursors. We have constructed and tested new higher temperature ceramic zirconium oxide and silicon carbide pyrolysis nozzles that can operate continuously at 1700 C for several hours. The two successful designs were used to generate intense beams of hydrocarbon radicals and carbenes by thermal decomposition of appropriate precursors that were inaccessible with our previous aluminum oxide designs. The new nozzle design makes possible quantitative sequential homolytic cleavage of a carbon-bromine bond to generate a radical, or two C-Br bonds to generate a carbene. We generated a molecular beam of propadienylidene (1-C3H2) from 1,3- dibromopropyne in this fashion. GRA

N91-27355# University of Southern Mississippi, Hattiesburg. Dept. of Polymer Science.
PHOTODEGRADATION OF POLYIMIDES. PART 3: THE EFFECT OF CHEMICAL COMPOSITION, RADIATION SOURCE, ATMOSPHERE AND PROCESSING Technical Report No. 8, 1 Jun. 1990 - 31 May 1991
Charles E. Hoyle and Edgardo T. Anzures 31 May 1991 44 p
(Contract N00014-89-J-1028)
(AD-A236197) Avail: NTIS HC/MF A03 CSCL 11/9

Polyimide films made from diarylanhydrides with oxygen, carbonyl, and hexafluoro isopropylidene 6F bridging groups are photolabile when irradiated with unfiltered light from a medium pressure mercury lamp. The presence of oxygen is necessary to the photolytic degradation process, which results in the ultimate oxidative ablation of thin polyimide films. Films based on the 6F dianhydride containing a hexafluoro isopropylidene hinge group are the most unstable. However, photolysis of 6F dianhydride based polyimides in an inert atmosphere with either the unfiltered medium pressure mercury lamp or an electron beam results in no detectable changes even after long exposure times. GRA

N91-27356# University of Southern Mississippi, Hattiesburg. Dept. of Polymer Science.
PHOTODEGRADATION OF POLYIMIDES. PART 4: MECHANISM FOR THE PHOTOOXIDATION PROCESS BASED ON A MODEL COMPOUND Technical Report No. 9, 1 Jun. 1990 - 31 May 1991
Charles E. Hoyle, D. Creed, R. Nagarajan, P. Subramanian, and Edgardo T. Anzures 31 May 1991 37 p
(Contract N00014-89-J-1028)
(AD-A236198) Avail: NTIS HC/MF A03 CSCL 11/9

Based on analysis of the photochemistry of a model compound, N-phenylphthalimide, the photolysis of polyimide derived from 4,'-oxydianiline (ODA) and a diarylanhydride with a hexafluorinated isopropylidene bridging group (6F) is proposed to proceed via formation from a phthalic anhydride type photoproduct. The quantum yield for product formation of N-phenylphthalimide is quite low (less than 10(exp -3)) indicating a rather inefficient first step in the overall oxidative degradation process. However, based on the efficiency of the of the photooxidation of the primary photoproducts, a process leading to the ultimate failure and complete ablation of the 6F-ODA films in air upon exposure to the unfiltered output of a mercury lamp is postulated. GRA

N91-27357# Illinois Univ., Chicago.
ALKYL AZIDES, DIAZIDES, HALOAZIDES AND BRIDGED POLYCYCLIC DIAZIDES Final Report, 1 Jul. 1989 - 14 Nov. 1990
Robert M. Moriarty 16 May 1991 34 p
(Contract N00014-89-J-3080)
(AD-A236202) Avail: NTIS HC/MF A03 CSCL 07/3

A series of monoazido alkanes and diazido alkanes have been synthesized. Specifically,1-azidobutane (100.0 g), 1-azidohexane (100.0 g), 1-azidooctane (100.0 g), and 1-azidoheptane (100.0 g), 1,3-diazidopropane (200.0 g), 1,4-diazidobutane (200.0 g, 1,5-diazidopentane (200.0 g), 1,6-diazidohexane (200.0 g), 1,7-diazidoheptane (200.0 g), 1,8-diazidooctane (200.0 g) were synthesized and characterized completely both analytically and spectroscopically. Among cyclic examples 1,2-diazido cyclopentane, 1,2-diazido cyclopentane, 1,2-diazido cyclohexane and 1,4-diazo cyclohexane were synthesized. Norbornene was converted into a regioisomeric mixture of 2,3-diazido and syn and anti-2,7-diazido norbornanes. The photodimer of nonbornadiene was synthesized and converted to the tetraazido analog. GRA

N91-27358# South Carolina Univ., Columbia. Dept. of Chemistry.
FACILE LI/HMPA-PROMOTED POLYMERIZATION METHOD FOR THE SYNTHESIS OF SOLUBLE POLY(PHENYLENES) Technnical Report, May 1990 - May 1991
James M. Tour and Eric B. Stephens 16 May 1991 10 p
(Contract N00014-89-J-3062)
(AD-A236236; TR-4) Avail: NTIS HC/MF A02 CSCL 07/6

A synthesis of poly(phenylene) is described by the treatment of 1-bromo-4-lithiobenzene with hexamethylphosphoramide (HMPA). The polymerization occurred nearly instantaneously even at -78 C. Conditions were optimized using dioxane as a solvent and HMPA addition at 70 to 80 C to afford poly(phenylenes) that are predominantly para-linked. The polymers are soluble in THF, dichloromethane, and chloroform. Analysis of the initially formed polymers showed that there was a high bromide content (approximately one bromide for every three aryl rings). Debromination of the material was achieved by treatment with butyllithium and quenching with water. The Mw of the debrominated polymer was 3178 by SEC analysis. Functionalization of the polymer was demonstrated by the lithium-halogen exchange on the initially formed brominated polymer followed by quenching with carbon dioxide to afford the carboxylated polymer. The brominated and debrominated polymers were shown to be electroactive. GRA

N91-27359# South Carolina Univ., Columbia. Dept. of Chemistry.
SYNTHESIS OF POLY(PHENYLENES) BY A RAPID POLYMERIZATION OF 1-BROMO-4-LITHIOBENZENE USING HMPA Technical Report, May 1990 - May 1991
James M. Tour and Eric B. Stephens 16 May 1991 7 p
(Contract N00014-89-J-3062)
(AD-A236237; TR-5) Avail: NTIS HC/MF A02 CSCL 07/6

A synthesis of poly(phenylene) is described by the treatment of 1-bromo-4-lithiobenzene with hexamethylphosphoramide (HMPA). The polymerization occurred nearly instantaneously even at -78 C. Conditions have been optimized using dioxane as a solvent and HMPA addition at 70 to 80 C to afford poly(phenylenes) that are predominantly para-linked. The polymers are soluble in THF, dichloromethane, and chloroform. Analysis of the initially formed polymers showed that there was a high bromide content (approximately one bromide for every three aryl rings). Debromination of the material was achieved by treatment with butyllithium and quenching with water. The MW of the debrominated polymer was 3178 by SEC analysis. GRA

N91-27360# University of Southern Mississippi, Hattiesburg. Dept. of Polymer Science.
PHOTODEGRADATION OF POLYIMIDES. PART 5: AN EXPLANATION OF THE RAPID PHOTOLYTIC DECOMPOSITION OF A SELECTED POLYIMIDE VIA ANHYDRIDE FORMATION Technical Report, 1 Jun. 1990 - 31 May 1991
C. E. Hoyle, Edgardo T. Anzures, and P. Subramanian 31 May 1991 45 p
(Contract N00014-89-J-1028)
(AD-A236247) Avail: NTIS HC/MF A03 CSCL 07/4

The photolytic decomposition in air of a polymide film based on a dianhydride and a diarylamine with hexafluoroisopropylidene

6F bridging groups is extremely rapid leading to efficient chain cleavage and subsequent photooxidative decomposition. Relatively short photolysis times with an unfiltered medium pressure mercury lamp are required to give a clean photoablation process of the 6F-6F polyimide films in the air. IR difference spectroscopy shows the appearance of anhydride groups on photolysis in air indicating a photooxidation process via decomposition of the arylimide linkage. A photophysical and photochemical analysis of several model N-arylphthalimides indicates that both solvent polarity and electron withdrawing/donating substituents can greatly alter the efficiency of the photolysis process. GRA

N91-27361# South Carolina Univ., Columbia. Dept. of Chemistry.
APPROACHES TO ORTHOGONALLY FUSED CONDUCTING POLYMERS FOR MOLECULAR ELECTRONICS Technical Report, May 1990 - May 1991
James M. Tour, Ruilian Wu, and Jeffry S. Schumm 16 May 1991 8 p
(Contract N00014-89-J-3062)
(AD-A236253; TR-3) Avail: NTIS HC/MF A02 CSCL 20/3

Described is the synthesis of two spiro core segments of orthogonally arranged conducting systems. The final systems are to have a potentially conducting chain fused perpendicularly to a second potentially conducting chain via a sigma bonded network. These systems may be suitable for incorporation into future molecular electronic devices. One of the core segments synthesized is based on a thiophene conducting group and it is formed by a zirconium-promoted bis(bicyclization) of bis(diyne) systems. The second is a phenylene-based system which is derived from fluorene. GRA

N91-27362# University of Southern Mississippi, Hattiesburg. Dept. of Polymer Science.
ULTRAVIOLET STABILITY OF POLYMERS CONTAINING THE HEXAFLUOROISOPROPYLIDENE GROUP Technical Report, 1 Jun. 1990 - 31 May 1991
C. E. Hoyle, R. Nagarajan, Edgardo T. Anzures, P. E. Cassidy, and K. M. Kane 31 May 1991 10 p
(AD-A236255; TR-7) Avail: NTIS HC/MF A02 CSCL 07/6

The photodecomposition of four polymer series containing the hexafluoroisopropylidene (6F) moiety was studied. We report herein the photostability of a poly(ether ketone) series when subjected to UV light in air. Replacement of isopropylidene with 6F results in decreased photostability for the PEKs as evidenced by changes in molecular weight and IR and UV-VIS spectra. Results for polyamides, polyimides, and polyarylates are also under study. GRA

N91-27363# Massachusetts Inst. of Tech., Cambridge. Dept. of Chemistry.
SILICON CERAMICS WITH A DASH OF BORON
Dietmar Seyferth, Herbert Plenio, William S. Rees, Jr., and Klaus Buechner 10 May 1991 15 p
(Contract N00014-82-K-0322)
(AD-A236410; TR-33) Avail: NTIS HC/MF A03 CSCL 07/3

This review deals with the synthesis of cross-linked silazanyl borazine polymers that are excellent precursors for BN/Si3N4 composites, with decaborane-diamine polymers that serve as BN precursors and with the serendipitous discovery of an ortho-carborane. GRA

N91-27364# National Inst. of Standards and Technology, Gaithersburg, MD.
SPATIALLY AND SPECTRALLY RESOLVED CATHODOLUMINESCENCE OF HOT-FILAMENT CHEMICAL-VAPOR-DEPOSITED DIAMOND PARTICLES Interim Report
Lawrence H. Robins, Edward N. Farabaugh, and Albert Feldman 24 Apr. 1991 43 p
(Contract N00014-90-F-0011)
(AD-A236485; TR-5) Avail: NTIS HC/MF A03 CSCL 07/4

Spectrally resolved cathodoluminescence (CL) image and spatially resolved CL spectra were obtained from two specimens grown by hot-filament chemical vapor deposition. Each specimen consisted of a large number of unconnected diamond particles with cubo-octahedral and pseudo-five-fold twinned growth habits. The growth temperature was nominally 600 deg C for one specimen and 750 C for the other. In the 1.5 to 3.5 eV range, the spectra are composed of four defect and impurity related bands: there are three bands with zero-phonon lines at 1.68, 2.156, and 2.325 eV, and one broad band centered at 2.85 eV. A weak at 5.27 eV, due to exciton recombination, was also observed. Spectrally resolved images to the two most intense CL bands, at 2.126 and 2.85 eV, were obtained for several particles. In the low temperature specimen, bright regions in images of the 2.85 eV band are correlated in some cases with the central regions of (100) facets. GRA

N91-27365# National Inst. of Standards and Technology, Gaithersburg, MD. Ceramics Div.
EFFECTS OF MULTIPLE FILAMENT GEOMETRY IN THE HOT FILAMENT DEPOSITION OF DIAMOND FILMS Interim Report
Edward N. Farabaugh, Albert Feldman, and Lawrence H. Robins 12 Apr. 1991 9 p
(Contract N00014-90-F-0011)
(AD-A236708; TR-4) Avail: NTIS HC/MF A02 CSCL 07/1

Scaleup of hot filament chemical vapor deposition of diamond films requires knowledge of how filament geometry affects the deposition process. The effect of multiple filament geometry on the growth rate and surface morphology of diamond films is presented. Three factors were varied: the number of helical turns in a filament (5, 10 or 15); the number of filaments present (1 or 2); and the CH4 fraction in the CH4-H2 feed gas mixture (0.25, 0.5, 0.75 or 1.0 percent). Other depositions parameters were a 750 C substrate temperature, 52 standard cm/m total feed gas flow rate, and 5300 Pa deposition pressure. The deposition chamber volume was 1.9 liters. Increasing the CH4 concentration in the feed gas results in higher growth rates. However, increasing the number of filament turns in dual filament systems resulted in lower than expected growth rates for dual 10 and 15 turn filaments. GRA

N91-27366# Rutgers - The State Univ., New Brunswick, NJ. Dept. of Mechanics and Materials Science.
ANNEALING EFFECTS ON PHASE 1 POLY(VINYLIDENE FLUORIDE)
Y. Takase, J. I. Scheinbeim, and B. A. Newman May 1991 31 p
(Contract N00014-88-K-0122)
(AD-A236741; TR-18) Avail: NTIS HC/MF A03 CSCL 07/4

The effects of annealing temperatures on stretched poly(vinylidene fluoride) films were systematically studied from the as-received condition up to the melting range (180 C). X ray diffraction studies indicate that the annealing process brings about better chain packing and increased crystallite perfection. The elastic modulus and piezoelectric strain and stress constants, d31 and e31, decrease as the annealing temperature, Ta, increases up to 160 C, while the remnant polarization, Pr, remains almost constant. Some of these characteristics may be interpreted in terms of a morphological transformation of microfibrils. GRA

N91-27367# Massachusetts Inst. of Tech., Cambridge. Dept. of Chemical Engineering.
POLYBUTADIENE CHAIN IMMOBILIZATION IN B-CORE, STAR-BRANCHED SB BLOCK COPOLYMERS
D. H. Rein, R. F. Baddour, and R. E. Cohen 21 May 1991 17 p
(Contract N00014-91-J-1045)
(AD-A236767; TR-4) Avail: NTIS HC/MF A03 CSCL 07/6

The equilibrium solubility of gases in a star-branched SB block copolymer can be reliably estimated from a volume fraction weighted average of the homopolymer solubilities; the value of heat of solution of gas in SB block copolymer lies between the two values associated with the constituent homopolymers. Diffusion coefficients for gases in SB block copolymers are bracketed by

the homopolymer values over the range of temperature employed, but the activation energies for diffusion in SB are higher than either of the homopolymer values. The anomalous temperature dependence and the inability of a computer stimulation to reproduce experimental diffusion coefficient values for SB supported the concept of a temperature dependent restriction on chain mobility in the polybutadiene regions of the SB block copolymer. This Beta factor has values of about 2-3 at room temperature but decreases to unity when the polystyrene chains become mobile at the polystyrene Tg. GRA

N91-27368# Rutgers - The State Univ., Piscataway, NJ. Dept. of Mechanics and Materials Science.
DISCHARGE POLING AND POLY(VINYLIDENE FLUORIDE) FILMS
Y. Takase, J. I. Scheinbeim, and B. A. Newman May 1991 27 p
(Contract N00014-88-K-0122)
(AD-A236810; TR-20) Avail: NTIS HC/MF A03 CSCL 07/6

A new poling technique was developed which is significantly different from the two conventional poling techniques; direct poling and corona poling. The present technique is based on the fact that the application of higher poling fields to poly(vinylidene fluoride) PVF2 films produces higher piezoelectric and pyroelectric responses but with a significantly higher risk of sample breakdown. This risk can be reduced by employing an active current limiter in the poling circuit. Experiments show that the risk of breakdown was significantly decreased by employing a discharge element connected in series with the sample. The element consists of a metal spark gap and a high resistance (1 G omega) connected in series which works as a pulse shaper by suppressing the initial surge current and shutting down the current with a suitable time constant. GRA

N91-27369# Missouri Univ., Rolla.
CHARACTERIZATION OF PLASMA POLYMERIZED HYDROCARBONS USING CP-MAS CARBON-13 NMR Interim Report, 1 Feb. 1990 - 1 Feb. 1991
Robert J. Gambogi, D. L. Cho, H. Yasuda, and Frank D. Blum 27 Feb. 1991 16 p
(Contract N00014-91-J-1274)
(AD-A236947; UMR-FDB-18) Avail: NTIS HC/MF A03 CSCL 07/3

Plasma polymerized hydrocarbons made from ethane and methane were produced under different reactor conditions and probed by solid-state carbon-13 nuclear magnetic resonance (NMR) with cross-polarization and magic angle sample spinning. NMR experiments provided structural information about the plasma polymers. The conditions of low power, high hydrocarbon gas flow rate, and no added hydrogen gas appeared to give the highest amount of non-protonated sp3 hybridized carbons in the films for the reactor design used. The use of methane or ethane as reactor gas did not affect plasma polymer structure significantly. GRA

N91-27370# Pennsylvania Univ., Philadelphia. Dept. of Chemistry.
POLYANILINE: INTER-RELATIONSHIP BETWEEN ULTRA-STRUCTURE AND PROPERTIES
Alan G. MacDiarmid, S. K. Manohar, E. M. Scherr, X. Tang, and M. A. Druy 10 Jun. 1991 7 p
(Contract N00014-90-J-1559)
(AD-A236993; Rept-1991-11) Avail: NTIS HC/MF A02 CSCL 09/1

The conductivity (doped form), degree of crystallinity, tensile strength, solubility and swellability (as a gel) of polyaniline (emeraldine oxidation state) is found to be greatly dependent on the past chemical and/or mechanical history of the polymer which significantly affects the ultrastructure of the material. The conductivity and tensile strength of polyaniline films and fibers can be greatly enhanced by stretch orientation which is also accompanied by a monotonic increase in crystallinity. The solubility of the emeraldine base in NMP is greatly decreased as the degree of crystallinity is increased. The conductivity shows relatively little dependency on molecular weight as compared to crystallinity; it first rises monotonically with increase in molecular weight and then remains essentially independent of molecular weight. Gels of oriented emeraldine base exhibit a remarkable anisotropic swelling in NMP and in mixtures of NMP/CH3OH. GRA

N91-27371# Rutgers - The State Univ., Piscataway, NJ. Dept. of Mechanics and Materials Science.
EFFECTS OF ANNEALING ON THE POLARIZATION SWITCHING OF PHASE 1 POLY(VINYLIDENE FLUORIDE)
Y. Takase, J. I. Scheinbeim, and B. A. Newman May 1991 28 p
(Contract N00014-88-K-0122)
(AD-A237015; Rept-15) Avail: NTIS HC/MF A03 CSCL 07/6

To obtain information about microscopic processes involved in the polarization switching in uniaxially oriented poly(vinylidene fluoride) film, a least squares estimation of nonlinear parameters was developed to yield parameters of an equation which describes the nucleation and domain growth process. The analysis showed that the value of the domain growth speed increased as Ta increased. This is consistent with x ray diffraction data which indicated that the annealing process brought about better chain packing and increased crystallite perfection. The analysis also showed that the nucleation probably significantly increased as Ta increased. This result was interpreted in terms of a morphological transformation, which was indicated by the decrease in elastic modulus with increasing Ta with no corresponding loss of orientation. It is suggested that the annealing process brought about an increase in the number of nucleation sites as a result of a transformation from a fibrous structure to a crystal-amorphous series structure which has increased boundary zone area. GRA

N91-27372* National Aeronautics and Space Administration. Pasadena Office, CA.
MOLECULES WITH ENHANCED ELECTRONIC POLARIZABILITIES BASED ON DEFECT-LIKE STATES IN CONJUGATED POLYMERS Patent
David N. Beratan, inventor (to NASA) (Jet Propulsion Lab., California Inst. of Tech., Pasadena.) 30 Apr. 1991 22 p Filed 10 Oct. 1989
(Contract NAS7-918)
(NASA-Case-NPO-17633-1-CU; US-Patent-5,011,907; US-Patent-Appl-SN-418611; US-Patent-Class-528-220; US-Patent-Class-528-222; US-Patent-Class-528-225; US-Patent-Class-528-227; US-Patent-Class-528-228; US-Patent-Class-528-230; US-Patent-Class-528-233) Avail: US Patent and Trademark Office CSCL 11C

Highly conjugated organic polymers typically have large non-resonant electronic susceptibilities, which give the molecules unusual optical properties. To enhance these properties, defects are introduced into the polymer chain. Examples include light doping of the conjugated polymer and synthesis, conjugated polymers which incorporate either electron donating or accepting groups, and conjugated polymers which contain a photoexcitable species capable of reversibly transferring its electron to an acceptor. Such defects in the chain permit enhancement of the second hyperpolarizability by at least an order of magnitude.
Official Gazette of the U.S. Patent and Trademark Office

28 PROPELLANTS AND FUELS

Includes rocket propellants, igniters, and oxidizers; their storage and handling procedures; and aircraft fuels.

For related information see also *07 Aircraft Propulsion and Power, 20 Spacecraft Propulsion and Power,* and *44 Energy Production and Conversion.*

N91-27373 Department of the Navy, Washington, DC.
RF AND DC DESENSITIZED ELECTROEXPLOSIVE DEVICE Patent
Thomas A. Baginski, inventor (to Navy) 6 Nov. 1990 7 p Filed 24 Jul. 1989

(AD-D014886; US-Patent-4,967,665; US-Patent-Appl-SN-386375; US-Patent-Class-102-202.2) Avail: US Patent and Trademark Office CSCL 19/1

An insensitive electroexplosive device to electrically ignite explosives is disclosed. This device is inherently immune to radio frequency (RF) radiation, and also provides protection against DC or very low frequency RF induced by arcing. A central feature is used of zeners and capacitors to form a reactively balanced bridge circuit. When constructed in semiconductor form as described, the device is capable of incorporation in small caliber ordnance. GRA

N91-27374# New Energy Development Organization, Tokyo (Japan).

ASSESSMENT OF EFFECTS PRODUCED BY THE INTRODUCTION OF FUEL METHANOL ON SOCIAL STRUCTURES

Mar. 1990 87 p In JAPANESE; ENGLISH summary
(DE91-778784; NEDO-P-8932) Avail: NTIS HC/MF A05

A description is first given of a scheme of the assessment concerned. It is noted that the process of supplying methanol in an increased amount to consumers, which starts from the acquirement of its raw materials, exerts direct impacts on industries, the consuming public, the environment an so on, and these impacts produce far-reaching effects on the national economy including industries. There is next a description of the simulation model which is capable of evaluating quantitatively the direct impacts and indirect effects that are produced by using fuel methanol in place of petroleum products mainly of transport use. Assuming some scenarios of the introduction of fuel methanol, the following quantities are calculated by means of this model; an estimate of demand for fuel methanol, the number of plants required for methanol production, the number of tankers required for transportation, necessary costs and others. Thirdly, results obtained by simulation analysis of the following two cases are presented: first, methanol is positively introduced so that it takes 50 percent share and 100 percent share of fuels required for all passenger cars and for buses in big cities, respectively, and replaces petroleum products of domestic and commercial use by 50 percent; second, methanol is gradually introduced as automobile fuel so that is takes finally 10 percent share for passenger cars in three biggest cities, 50 percent share both for normal and small-sized trucks and for light weight commercial trucks in big cities, and 100 percent share for busses in big city areas. Furthermore, it is noted that the present simulation model can be modified so as to evaluate effects of introducing methanol to other fields of industry such as power generation. Author

N91-27375*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, OH.

AUTOGENOUS PRESSURIZATION OF CRYOGENIC VESSELS USING SUBMERGED VAPOR INJECTION

Robert J. Stochl, Neil T. VanDresar, and Raymond F. Lacovic 1991 10 p Presented at the Cryogenic Engineering and International Cryogenic Materials Conference, Huntsville, Al, 11-14 Jun. 1991; cosponsored by NASA. Marshall Space Flight Center and Alabama Univ.
(NASA-TM-104516; E-6386; NAS 1.15:104516) Avail: NTIS HC/MF A02 CSCL 20D

Experimental results are reported for submerged injection pressurization and expulsion tests of a 4.89 cu m liquid hydrogen tank. The pressurant injector was positioned near the bottom of the test vessel to simulate liquid engulfment of the pressurant gas inlet; a condition that may occur in low-gravity conditions. Results indicate a substantial reduction in pressurization efficiency, with pressurant gas requirements approximately five times greater than ideal amounts. Consequently, submerged vapor injection should be avoided as a low-gravity autogenous pressurization method whenever possible. The work presented herein validates that pressurent requirements are accurately predicted by a homogeneous thermodynamic model when the submerged injection technique is employed. Author

N91-27376# Ballistic Research Labs., Aberdeen Proving Ground, MD.

BRLCB: A CLOSED CHAMBER DATA ANALYSIS PROGRAM WITH PROVISIONS FOR DETERRED AND LAYERED PROPELLANTS Final Report, Jul. 1987 - Dec. 1988

W. F. Oberle and D. E. Kooker Apr. 1991 32 p
(AD-A235618; BRL-TR-3227) Avail: NTIS HC/MF A03 CSCL 19/1

BRLCB is a PC-based data analysis program designed to perform all data analysis associated with closed chamber experiments. Included in the program are provisions for deterred and layered propellants as well as homogeneous propellants. The basic features of the program are presented and validated, and future plans and additions to the program are outlined. GRA

N91-27377# Ballistic Research Labs., Aberdeen Proving Ground, MD.

TWO-STAGE IGNITER TEST RESULTS: ELECTRICAL IGNITION OF LGP 1846 Final Report, Aug. 1989 - Sep. 1990

James DeSpirito, G. P. Reeves, and John D. Knapton Apr. 1991 26 p
(DA Proj. 1L2-63637-D-155)
(AD-A235619; BRL-TR-3229) Avail: NTIS HC/MF A03 CSCL 19/1

Test results from a two-stage, electrical liquid propellant igniter are described. Two critical areas are identified relating to the operation of the igniter. The first is the confinement of the liquid propellant in the ignition cavity and the second is the interaction of the gases venting from the precombustion chamber with the liquid propellant booster charge in the antechamber. The design modifications made to ensure proper operation are presented. Typical electrode gap voltage and current values ranged from approx. 1,000 to 1,500 V and approx. 175 to 185 A, respectively. The energy dissipated into the igniter ranged from 21 to 30 J, with only 10 to 30 pct. of this energy due to the arc phase of the discharge. Typical maximum pressures were 502 MPa in the precombustion chamber and 329 MPa in the antechamber. The results of five tests staging up to the maximum booster charge are also presented. The average test chamber pressure rise time in these five tests was 3.55 ms, or about 5.4 MPa/ms in the test at maximum charge. A test successfully demonstrating arcless ignition is also presented. The performance with arcless ignition was comparable to that achieved in arc-based ignition tests. GRA

N91-27378# Army Cold Regions Research and Engineering Lab., Hanover, NH.

AUTOMOTIVE FUELS AT LOW TEMPERATURES Technical Digest

Deborah Diemand Mar. 1991 27 p
(AD-A236040; CRREL-TD-91-2) Avail: NTIS HC/MF A03 CSCL 21/4

Problems with fuels at extremely low temperatures are largely due to wax formation, increased viscosity, decreased volatility, and contamination by water. This is especially true of diesel fuels, but even gasoline suffers from these problems to some extent. Some difficulties may begin to appear at temperatures above 0 C. The majority of fuels are derived from petroleum crude oil. In addition, secondary processing of the crude procedures further fuel stocks from other fractions that could not otherwise be used as fuel. Cracking reduces large molecules from light gases or from the lighter products of the cracking process; polymerization is similar to alkylation but results in products with a lower octane rating; reforming catalytically alters certain low-octane substances, resulting in a high-octane product. The four basic molecular structures in petroleum oil products are aromatics, naphthenes, olefins, and paraffins. GRA

N91-27379# Allied-Signal Corp., Des Plaines, IL. Engineered Materials Research Center.

IMPROVED BORON FOR ENHANCED COMBUSTION Interim Report, Feb. 1986 - Dec. 1988

Steven Miller and Thomas M. Mezza Jun. 1990 260 p

(Contract F33615-85-C-2550)
(AD-A236564; WRDC-TR-89-2031) Avail: NTIS HC/MF A12 CSCL 21/2

The objective of this effort was to develop a domestic commercial process for producing pure, spherical, amorphous boron particles with diameters in the range of 0.5 to 3 microns. Such particles could offer improved combustion and processing properties over present commercial boron powders when incorporated into slurry and solid fuels. The approach was to start with the Callery process for making high-purity, submicron size boron, then change process variables and add a recycle in an attempt to increase particle size. Pure, spherical particles approaching 0.1 micron were achieved. Allied-Signal EMRC provided the overall program management, boron analysis, and characterization. GRA

N91-28108*# National Aeronautics and Space Administration. Langley Research Center, Hampton, VA.
EVALUATION OF ON-BOARD HYDROGEN STORAGE METHODS FOR HYPERSONIC VEHICLES
Ates Akyurtlu, J. F. Akyurtlu, A. A. Adeyiga, Samara Perdue (Hampton Univ., VA.), and G. B. Northam *In* Alabama A & M Univ., NASA-HBCU Space Science and Engineering Research Forum Proceedings 1989 p 329-33 (For primary document see N91-28063 19-99)
Avail: NTIS HC/MF A23 CSCL 21D

29 MATERIALS PROCESSING

Includes space-based development of products and processes for commercial applications.
For biological materials see *55 Space Biology.*

N91-27380*# Alabama Univ., Huntsville. Center for Microgravity and Materials Research.
VIBRATION ISOLATION TECHNOLOGY: SENSITIVITY OF SELECTED CLASSES OF EXPERIMENTS TO RESIDUAL ACCELERATIONS Final Report, 1 Jul. 1988 - 30 Jun. 1991
J. Iwan D. Alexander 1991 111 p
(Grant NAG8-724)
(NASA-CR-188662; NAS 1.26:188662) Avail: NTIS HC/MF A06 CSCL 22A

Work was completed on all aspects of the following tasks: order of magnitude estimates; thermo-capillary convection - two-dimensional (fixed planar surface); thermo-capillary convection - three-dimensional and axisymmetric; liquid bridge/floating zone sensitivity; transport in closed containers; interaction: design and development stages; interaction: testing flight hardware; and reporting. Results are included in the Appendices. B.G.

31 ENGINEERING (GENERAL)

Includes vacuum technology; control engineering; display engineering; cryogenics; and fire prevention.

N91-27381# Pennsylvania State Univ., University Park. Dept. of Civil Engineering.
COMPARATIVE STUDY OF DESIGN METHODS FOR TWO-WAY REINFORCED CONCRETE SLAB SYSTEMS M.S. Thesis
Robert J. Gibbs Dec. 1990 70 p
(AD-A234081) Avail: NTIS HC/MF A04 CSCL 11/2

The first reinforced concrete slab was built by C. A. P. Turner in 1906. This first slab design, which was used for a Minneapolis project, had to be load tested to satisfy the building code because no one had experience in the design of concrete slabs. The problem for the designer is to decide which method is most appropriate for a given slab. It must be determined whether the chosen method satisfies strength and serviceability requirements and whether the solution is economical from both a design and construction point of view. The purpose is to examine different methods of two-way slab design and compare the results to assess the relative merits of design methods. GRA

N91-27382# Army Lab. Command, Watertown, MA. Material Technology Lab.
AN ANALYSIS OF THREE PULTRUSION MODELS PROPOSED FOR USE IN A PULTRUSION CONTROL SYSTEM Final Report
Donald J. Jaklitsch and Maria T. Bostic Apr. 1991 38 p
(DA Proj. 1L1-62105-AH-84)
(AD-A235600; MTL-TR-91-12) Avail: NTIS HC/MF A03 CSCL 13/8

Three mathematical models currently under consideration for use in real time control of the pultrusion process were implemented and compared. The results of the simulations were compared to each other, and to an experimentally acquired thermal history of pultruded glass/epoxy bar stock, in order to determine the suitability of the various models to the process and control environment. The sensitivity of the models to variations in materials properties and kinetics parameters was also investigated. The models were run with values of thermal diffusivity, heat of reaction, rate of reaction, and activation energy which were varied by amounts within the realm of experimental error. As a continuous processing technique, pultrusion offers the advantage of a less expensive method of fabrication than alternative processes. However, the continuous nature of pultrusion presents problems in process control not encountered in continuous fully liquid processes. The plug flow nature of the pultrusion process is not conducive to continuous process monitoring since internal sensors which, when used, necessarily become incorporated into the product. Effort was extended toward developing compatible and nondestructive sensors for inclusion in composite structures. GRA

N91-27383# Institute for Defense Analyses, Alexandria, VA.
CONCURRENT ENGINEERING TEAMS. VOLUME 2: ANNOTATED BIBLIOGRAPHY
Karen J. Richter and David A. Dierolf Nov. 1990 116 p
(Contract MDA903-89-C-0003)
(AD-A236094; IDA-P-2516-Vol-2; IDA/HQ-90-36608; AD-E501382)
Avail: NTIS HC/MF A06 CSCL 05/1

Specific concurrent engineering practices vary among organizations. There are, however, various management practices that appear to work well for most organizations. This paper presents the reader with specific, useful examples from several defense contractors illustrating how multifunctional concurrent engineering teams are being organized and managed and how concurrent engineering team meetings are conducted and supported. The types of computer support that could be used to enhance the efficiency and effectiveness of concurrent engineering team meetings are identified. The general findings are that there exists a direct relationship between total quality management (TQM) and concurrent engineering, and that many applications of computer-aided group problem solving are possible and practical today for the concurrent engineering team meetings. Areas identified for additional research are the documentation of the decision process and rationale during the product and process definition, the capturing of lessons learned during the implementation of concurrent engineering, and the performance evaluation and training of team members. GRA

N91-27384# Aerodyne Research, Inc., Billerica, MA.
PATTERNED ETCHING OF INFRARED DETECTOR ARRAYS Final Report, 7 Jun. - 31 Dec. 1990
Andrew Freedman 19 Mar. 1991 25 p
(Contract DAAB07-90-C-F422)
(AD-A236124; ARI-RR-836) Avail: NTIS HC/MF A03 CSCL 13/8

A pattern etching technique was developed for infrared detector arrays based on photo-induced processes. The technique is based on the efficacy of methyl radical etching of II-VI compounds such as HgCdTe and CdTe. Methyl radicals were produced in a pattern above a HgCdTe substrate by photodissociating a radical precursor such as acetone or nitromethane using an excimer laser operating

at 193 nm. Neither optical nor scanning electron microscopy could confirm the presence of any etching action. The failure of the proposed technique is ascribed to surface scavenging and/or reaction quenching mechanisms. GRA

N91-27385* National Aeronautics and Space Administration. Pasadena Office, CA.
FLEXIBLE THERMAL APPARATUS FOR MOUNTING OF THERMOELECTRIC COOLER Patent
Jack A. Jones, inventor (to NASA), S. Walter Petrick, inventor (to NASA), and Steven Bard, inventor (to NASA) (Jet Propulsion Lab., California Inst. of Tech., Pasadena.) 16 Jul. 1991 10 p Filed 31 Jul. 1990
(Contract NAS7-918)
(NASA-Case-NPO-17806-1-CU; US-Patent-5,031,689; US-Patent-Appl-SN-560908; US-Patent-Class-165-1; US-Patent-Class-165-185; US-Patent-Class-136-204; Int-Patent-Class-F28F-7/00) Avail: US Patent and Trademark Office CSCL 13B

A flexible heat transfer apparatus used to flexibly connect and thermally couple a thermoelectric cooler to an object to be cooled is disclosed. The flexible heat transfer apparatus consists of a pair of flexible corrugated sheets made from high thermal conductivity materials such as copper, aluminum, gold, or silver. The ridges of the corrugated sheets are oriented perpendicular to one another and bonded sandwich-fashion between three plates to define an upper section and a lower section. The upper section provides X flexure, the lower section provides Y flexure, and both sections together provide Z flexure.
Official Gazette of the U.S. Patent and Trademark Office

N91-27386# Harvard Univ., Cambridge, MA. Div. of Applied Sciences.
CEILING JET IN FIRES
H. W. Emmons Dec. 1990 51 p Sponsored by NIST, Gaithersburg, MD
(Grant NIST-60NANBBD0845)
(PB91-167197; NIST/GCR-90/582) Avail: NTIS HC/MF A04 CSCL 13B

The steady ceiling jet is examined with a simplified top heat theory. Friction causes the jet to change down-stream with flow, depth, and/or hydraulic jump adjustments to produce Richardson number equals 1 at the corridor exit, just as in hydraulics. Entrainment has a qualitative effect identical to friction, although these are quantitative differences. Heat transfer has, however, the opposite effect; the Richardson number moves away from 1 as the flow proceeds. When all effects are included, high friction cases are predictable, while low friction cases are not. New experimental studies are needed to locate the reasons. Author

N91-28127*# Howard Univ., Washington, DC. Dept. of Systems and Computer Science.
SUGGESTED CRITERIA FOR EVALUATING SYSTEMS ENGINEERING METHODOLOGIES
Audrey Gates, Arthur S. Paul, and Tepper L. Gill *In* Alabama A & M Univ., NASA-HBCU Space Science and Engineering Research Forum Proceedings 1989 p 489-49 (For primary document see N91-28063 19-99)
Avail: NTIS HC/MF A23 CSCL 13B

32 COMMUNICATIONS AND RADAR

Includes radar; land and global communications; communications theory; and optical communications.

For related information see also *04 Aircraft Communications and Navigation* and *17 Space Communications, Spacecraft Communications, Command and Tracking.* For search and rescue see *03 Air Transportation and Safety,* and *16 Space Transportation.*

N91-27387# Office of Naval Research European Office, FPO New York, NY.
MW 08-MULTI-BEAM AIR AND SURFACE SURVEILLANCE RADAR
6 Sep. 1989 2 p
(AD-A233492; ONREUR-MASB-44-89) Avail: NTIS HC/MF A01 CSCL 17/9

Signal of the Netherlands has developed and is marketing the MW 08, a 3-D radar to be used for short to medium range surveillance, target acquisition, and tracking. MW 08 is a fully automated detecting and tracking radar. It is designed to counter threats from aircraft and low flying antiship missiles. It can also deal with the high level missile threat. MW 08 operates in the 5 cm band using one antenna for both transmitting and receiving. The antenna is an array, consisting of 8 stripline antennas. The received radar energy is processed by 8 receiver channels. These channels come together in the beam forming network, in which 8 virtual beams are formed. From this beam pattern, 6 beams are used for the elevation coverage of 0-70 degrees. MW 08's output signals of the beam former are further handled by FFT and plot processors for target speed information, clutter rejection, and jamming suppression. A general purpose computer handles target track initiation, and tracking. Tracking data are transferred to the command and control systems with 3-D target information for fastest possible lockon. GRA

N91-27388 Department of the Navy, Washington, DC.
GENERIC RADAR DISPLAY Patent
John H. Allen, inventor (to Navy) and Robert S. Reif, inventor (to Navy) 31 Jul. 1990 11 p Filed 2 Oct. 1989
(AD-D014884; US-Patent-4,944,679; US-Patent-Appl-SN-416201; US-Patent-Class-434-28) Avail: US Patent and Trademark Office CSCL 17/9

The invention relates to the field of training devices, and in particular to simulators for the display of radar data. The invention is adaptable in that its software can be modified for compatibility with a variety of target generators; and, then when the invention is appropriately instructed, it will interact with the generator to create an accurate and responsive visual display of the data provided by the generator in accordance with settings selected by the user. The present invention is a system for accepting simulated radar display information from a target generator and displaying that information on a simulated radar display console. It comprises a general purpose computer that has been prepared to monitor the user inputs on the front panel of the console, acquire data from and communicate with the generator, and implement the functions indicated by the user that normally are performed by specially built hardware. Preparation of the computer refers to the selection of appropriate boards and additional hardware, and to the use of an adaptable application software system. First, the software system initializes and tests the radar display system. Then, the normal operational mode of the software program is entered if no errors are detected. GRA

N91-27389# Federal Aviation Administration, Atlantic City, NJ.
EVALUATION OF EXTERNAL FILTERS IN REDUCING TYPE B1 AND B2 FM BROADCAST INTERFERENCE TO VHF COMMUNICATIONS AVIONICS RECEIVERS
Martin Badinelli and Arthur Cushman Jul. 1991 23 p
(DOT/FAA/CT-TN91/16) Avail: NTIS HC/MF A03

Commercial FM broadcast stations radiate high power signals in commercial airspace that can produce type B1, third order intermodulation products, interference in the aviation very high frequency (VHF) communications band. It has been proposed that

passive, external filters may be a possible solution to this problem. Tests performed on three passive, external filters at the Federal Aviation Administration (FAA) Technical Center are described. These tests compared avionics transceiver performance both with and without the filter installed and were performed in a controlled laboratory environment, using eight avionics transceivers. It was found that passive, external filters can reduce interference effects due to Type B1 intermodulation in some cases. However, this was only a technical investigation of the filters and as such did not consider other issues; e.g., (1) certification requirements, (2) cost versus benefit, and (3) environmental operating conditions. These issues must be fully evaluated prior to any installations.
Author

N91-27390# Advisory Group for Aerospace Research and Development, Neuilly-Sur-Seine (France). Electromagnetic Wave Propagation Panel.
ELECTROMAGNETIC INTERFERENCE AND ELECTROMAGNETIC COMPATIBILITY
Jun. 1991 146 p Lecture Series held in Kjeller, Norway, 10-11 Jun. 1991; in Koenigswinter, Fed. Republic of Germany, 13-14 Jun. 1991; and in Lisbon, Portugal, 17-18 Jun. 1991
(AGARD-LS-177; ISBN-92-835-0620-0) Copyright Avail: NTIS HC/MF A07; Non-NATO Nationals requests available only from AGARD/Scientific Publications Executive

Two aspects of the current electromagnetic (EM) environment having great significance for NATO systems are: (1) electromagnetic interference (EMI); and (2) electromagnetic compatibility (EMC). The Lecture Series first sets EMC in a NATO operational context. Major EMI generation mechanisms are then reviewed and their characteristics outlined. The manner in which EMI energy couples into EM systems is discussed, together with the analysis and modeling tools available to assist in computing such interactions. Modern EMC testing methods and environments are then examined and their limitations indicated. The relationship between NATO and civilian EMC requirements are examined in the light of the European Community EMC Directive. Consideration is also given to the problems of spectrum management. Finally, design principles and techniques for EM systems with effective EMC characteristic are presented. For individual titles, see N91-27391 through N91-27399.

N91-27391# SRI International Corp., Arlington, VA. Information and Telecommunications Sciences Center.
NATURAL AND MAN-MADE NOISE AND INTERFERENCE: MECHANISMS AND CHARACTERISTICS Abstract Only
G. H. Hagn *In* AGARD, Electromagnetic Interference and Electromagnetic Compatibility Jun. 1991 2 p (For primary document see N91-27390 19-32)
Copyright Avail: NTIS HC/MF A07; Non-NATO Nationals requests available only from AGARD/Scientific Publications Executive

The objective is to define noise (a cause) and interference (an effect) and describe some of the sources of both natural and man-made radio noise and interference which have the potential to degrade the performance of radio and other electromagnetic systems of interest to NATO. The following types of sources are included: natural noise (e.g., from lightning, the sun, and the cosmos); and man-made noise (e.g., from external sources such as powerlines and ignition systems and from sources internal to a receiving system associated with electronic devices and components). The source mechanisms are discussed as well as the characteristics of the sources and their signatures in the bands from extremely low frequency through super high frequency. The Consultative Committee for International Radio (CCIR) estimates of worldwide minimum effective antenna noise figures versus frequency and empirical noise models (for noise of natural and man-made origin) are presented and discussed. Modeling the composite noise environment generated by multiple types of sources is discussed. The analytical models of Hall and Middleton are described. The proper combining (in a model of overall system noise figure) of the predictions of models for individual external and internal noise sources are discussed. The effect of noise on analog voice and on digital communications systems also discussed. High frequency channel occupancy and band congestion are defined, and the measurement and modeling of congestion are discussed. Noise measurements and standards are reviewed, and future noise trends are discussed. Author

N91-27392# York Univ. (England). Dept. of Electronics.
PROPAGATION AND COUPLING MECHANISMS
A. C. Marvin *In* AGARD, Electromagnetic Interference and Electromagnetic Compatibility Jun. 1991 13 p (For primary document see N91-27390 19-32)
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The background electromagnetic theory needed to understand the phenomena that lead to (EMC) problems, the techniques used to alleviate the problems, and the measurement techniques used to assess the problems are covered. A discussion of the concepts associated with vector and scalar fields are discussed and then Maxwell's Equations and their solution in the form of electromagnetic waves are reviewed. The structure and properties of electromagnetic waves are also reviewed. Concepts associated with inductive and radiative coupling between circuits are discussed, and the boundary between the two coupling types is explored in terms of the separation of the coupled circuits as a fraction of the wavelength. Author

N91-27393# Concordia Univ., Loyola Campus, Montreal (Quebec). Electromagnetic Compatibility Lab.
NUMERICAL ANALYSIS AND MODELLING TECHNIQUES
Stanley J. Kubina *In* AGARD, Electromagnetic Interference and Electromagnetic Compatibility Jun. 1991 18 p Sponsored in part by Department of National Defence and Defence Research Establishment (For primary document see N91-27390 19-32)
Copyright Avail: NTIS HC/MF A07; Non-NATO Nationals requests available only from AGARD/Scientific Publications Executive

The complex task of ensuring the electromagnetic compatibility of modern avionic/weapon systems can be made more manageable by the effective use of numerical analysis and modeling techniques. The acquisition and use of computer codes for system analysis and electromagnetic modeling is rewarded by a clearer appreciation of the individual interactions between systems and by the definition of coupling mechanisms. Such use also involves and requires the generation of a progressively improved data base of information on equipment characteristics and radiating elements. The modern computational tools which can be exploited in the complex task of assuring the electromagnetic compatibility of modern avionic/weapon systems are discussed. Author

N91-27394# Kentucky Univ., Lexington. Dept. of Electrical Engineering.
CABLES AND CROSSTALK
Clayton R. Paul *In* AGARD, Electromagnetic Interference and Electromagnetic Compatibility Jun. 1991 14 p (For primary document see N91-27390 19-32)
Copyright Avail: NTIS HC/MF A07; Non-NATO Nationals requests available only from AGARD/Scientific Publications Executive

Crosstalk is the unintentional electromagnetic coupling between circuits which are connected by parallel conductors that lie in close proximity to each other. Some examples are wires in cable harnesses or metallic lands on printed-circuit boards (PCB's). This unintended interaction between two or more circuits via their electromagnetic fields can cause interference problems. Signals from one circuit that couple to another circuit appear at the terminals of the devices that are interconnected by the wires. If these signals are of sufficient magnitude or spectral content, they may cause unintended operation of the device or a degradation in its performance. A summary of the standard models used for predicting crosstalk in various types of configurations is presented. The discussion focusses on the relative accuracies, regions of applicability, and computational complexity of the models. A simple explanation of the ability (or inability) of shielded wires and twisted pairs of wires to reduce the crosstalk is also given. Author

N91-27395# Katholieke Industriele Hogeschool West Vlaanderen, Oostende (Belgium).
GROUNDING, SHIELDING, AND BONDING
J. Catrysse *In* AGARD, Electromagnetic Interference and Electromagnetic Compatibility Jun. 1991 10 p (For primary document see N91-27390 19-32)
Copyright Avail: NTIS HC/MF A07; Non-NATO Nationals requests available only from AGARD/Scientific Publications Executive

In the electromagnetic compatibility design (EMC) of systems and circuits, both grounding and shielding are related to the coupling mechanisms of the system with (radiated) electromagnetic fields. Grounding is more related to the source or victim circuit (or system) and determines the characteristic of the coupling mechanism between fields and currents/voltages. Shielding is a way of interacting in the radiation path of an electromagnetic field. The basic principles and practical design rules are discussed. Author

N91-27396# FitzSimons (T. K.), Bergerac (France).
A REVIEW OF THE NATO EMC ANALYSIS PROGRAMME AND RELATED EUROPEAN COMMUNITY DEVELOPMENTS
T. K. FitzSimons *In* AGARD, Electromagnetic Interference and Electromagnetic Compatibility Jun. 1991 12 p (For primary document see N91-27390 19-32)
Copyright Avail: NTIS HC/MF A07; Non-NATO Nationals requests available only from AGARD/Scientific Publications Executive

In support of the International Military Staff and the Allied Radio Frequency Agency, there has been a NATO electromagnetic compatibility (EMC) Analysis Program since 1973. Early work involved compatibility of fixed frequency systems and the development of frequency assignment models. More recently, the work has involved problems associated with the compatibility of frequency hopping systems and their management. Increasing competition for limited spectrum space by both military systems themselves and also by civil systems coupled with the need for more dynamic frequency management in the battlefield poses many compatibility interests for the future. Military and civil EMC interests are also becoming more inter-related because of European Community decisions concerning telecommunications and electronic devices. A review of the program and related developments in Europe are presented. Author

N91-27397# Hull Univ. (England). Communications Research Group.
SPECTRUM MANAGEMENT AND CONSERVATION
M. Darnell *In* AGARD, Electromagnetic Interference and Electromagnetic Compatibility Jun. 1991 25 p (For primary document see N91-27390 19-32)
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A review of the basic concepts of radio spectrum utilization and the physical mechanisms of electromagnetic (EM) wave propagation of relevance to radio, radar, control, and navigation systems is presented. Then, a survey of the uses of the various bands in the radio frequency (RF) spectrum is also presented. Interactions between the propagation mechanisms introduced previously and frequency planning requirements are considered, making reference to the precision of available modeling and prediction procedures; emphasis is given to interference generation potential. Attention is then turned to equipment and system design features which affect their spectral occupancy characteristics, including RF equipment imperfections, signal design, system design and control, and cositing problems. Finally, the manner in which the bands of the radio spectrum are allocated and controlled is outlined, and areas of possible future concern in both NATO and civil operations identified. Author

N91-27398# York Univ. (England). Dept. of Electronics.
MEASUREMENT ENVIRONMENTS AND TESTING
A. C. Marvin *In* AGARD, Electromagnetic Interference and Electromagnetic Compatibility Jun. 1991 24 p (For primary document see N91-27390 19-32)
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The various methods used to assess both the emission (interference generation) performance of electronic equipment and the immunity of electronic equipment to external electromagnetic interference are described. The measurement methods attempt to simulate realistic operating conditions for the equipment being tested, yet at the same time they must be repeatable and practical to operate. This has led to the development of a variety of test methods, each of which has its limitations. Concentration is on the most common measurement methods such as open-field test sites, screened enclosures and transverse electromagnetic (TEM) cells. The physical justification for the methods, their limitations, and measurement precision are described. Ways of relating similar measurements made by different methods are discussed, and some thoughts on future measurement improvements are presented. Author

N91-27399# Katholieke Industriele Hogeschool West Vlaanderen, Oostende (Belgium).
DESIGN PRINCIPLES OF EFFECTIVE EMC
J. Catrysse *In* AGARD, Electromagnetic Interference and Electromagnetic Compatibility Jun. 1991 15 p (For primary document see N91-27390 19-32)
Copyright Avail: NTIS HC/MF A07; Non-NATO Nationals requests available only from AGARD/Scientific Publications Executive

Effective electromagnetic compatibility (EMC) design is directly related on minimizing the different effects in EMC: electromagnetic environment (EME), electromagnetic susceptibility, and the coupling/transmission paths. A short overview is given of the most important factors concerned with EMC design. It follows design parameters and design rules for each item. Author

N91-27400# Sandia National Labs., Albuquerque, NM.
A MEASUREMENT SYSTEM FOR AIRCRAFT/WEAPON ELECTROMAGNETIC COMPATIBILITY
T. D. Mounteer, L. D. Scott, and L. E. Stevenson 1991 9 p Presented at the 1991 Society of Women Engineers National Convention, San Diego, 23-29 Jun. 1991
(Contract DE-AC04-76DP-00789)
(DE91-011504; SAND-91-0852C; CONF-9106177-3) Avail: NTIS HC/MF A02

An electromagnetic measurement system (EMMS) was designed and constructed to provide essential data relating to electromagnetic compatibility (EMC) of modern weapons carried on military aircraft. This system measures the equivalent plane wave electric and magnetic fields impinging on a weapon's exterior surface arising from electromagnetic radiators on board host or nearby aircraft. To relate practical sensor responses to specified equivalent plane wave EMC field levels, a modern weapon shape was used as the primary sensor element which responds with a simple dipole antenna response at the lower frequencies and is instrumented with local skin current sensors. At higher frequencies, the locally induced currents can be related to the incident fields by simple scattering theory. Finally, an error analysis that catalogs all measurement path elements was performed to provide an error bound on the equivalent free electric field measurements reported by the EMMS. DOE

N91-27401*# National Aeronautics and Space Administration. Langley Research Center, Hampton, VA.
TRANSVERSE ELECTRIC SCATTERING WIDTHS FOR STRIPS-FOURIER TRANSFORM TECHNIQUE
C. R. Cockrell, S. D. Harrah, and F. B. Beck Jun. 1991 19 p
(NASA-TM-102729; NAS 1.15:102729) Avail: NTIS HC/MF A03 CSCL 20N

A technique which is based on Fourier transformations is introduced for predicting scattering widths. For a strip it is shown that explicit determination of the linear current density is not necessary for bistatic or monostatic scattering width calculations. Comparisons of the predictions of the technique are made with the integral equation technique predictions, which do not require explicit evaluations of linear current densities. Author

N91-27402*# Clemson Univ., SC. Radar Systems Lab.
THE PULSE-PAIR ALGORITHM AS A ROBUST ESTIMATOR OF TURBULENT WEATHER SPECTRAL PARAMETERS USING AIRBORNE PULSE DOPPLER RADAR Final Report
Ernest G. Baxa, Jr. and Jonggil Lee Washington Jul. 1991 40 p
(Grant NAG1-928)
(NASA-CR-4382; NAS 1.26:4382; DOT/FAA/RD-91/17; TR-022891-3570P) Avail: NTIS HC/MF A03 CSCL 17I

The pulse pair method for spectrum parameter estimation is commonly used in pulse Doppler weather radar signal processing since it is economical to implement and can be shown to be a maximum likelihood estimator. With the use of airborne weather radar for windshear detection, the turbulent weather and strong ground clutter return spectrum differs from that assumed in its derivation, so the performance robustness of the pulse pair technique must be understood. Here, the effect of radar system pulse to pulse phase jitter and signal spectrum skew on the pulse pair algorithm performance is discussed. Phase jitter effect may be significant when the weather return signal to clutter ratio is very low and clutter rejection filtering is attempted. The analysis can be used to develop design specifications for airborne radar system phase stability. It is also shown that the weather return spectrum skew can cause a significant bias in the pulse pair mean windspeed estimates, and that the poly pulse pair algorithm can reduce this bias. It is suggested that use of a spectrum mode estimator may be more appropriate in characterizing the windspeed within a radar range resolution cell for detection of hazardous windspeed gradients. Author

N91-27403# Federal Aviation Administration, Atlantic City, NJ.
GLOSSARY OF OPTICAL COMMUNICATION TERMS
James S. Beaty Apr. 1991 48 p
(Contract DOT-TO-302Y)
(DOT/FAA/CT-TN91/9) Avail: NTIS HC/MF A03

This glossary contains definitions of technical terms commonly used in the field of optical communication. It is intended for those who already have a technical background (engineers, scientists, and technicians), but are not familiar with the terminology of optical communication. Readers should note that for purposes of Federal procurement, official definitions of terms related to telecommunication, of which optical communication is a subset, may be found in Federal Standard 1037A, Glossary of Telecommunications. (A revision, FS-1037B, is in preparation.) The present document contains a number of entries not found in FS-1037B, and although not legally an arbiter of the official definitions found there, serves in many cases to amplify and/or clarify those definitions, Also, among the notes accompanying the definitions herein are a number of mini-totorials that address certain matters which experience has shown to have led to confusion on the part of some individuals involved in one or more aspects of optical communication. Author

N91-27404# Federal Aviation Administration, Atlantic City, NJ.
CONTROLLER EVALUATION OF INITIAL DATA LINK EN ROUTE AIR TRAFFIC CONTROL SERVICES: MINI STUDY 3 Final Report
Hank Marek, Ephraim Shochet, Evan Darby, Frank Buck, David Sweeney, and Preston Cratch (Mitre Corp., McLean, VA.) Jun. 1991 131 p
(Contract T2001G)
(DOT/FAA/CT-91/11) Avail: NTIS HC/MF A07

The results of Mini Study 3 conducted November 5-9, 1990 are presented. This Mini Study was conducted at the Federal Aviation Administration (FAA) Technical Center utilizing the Washington Air Route Traffic Control Center (ARTCC) airspace in the Data Link test bed. Initial Data Link en route services were evaluated in order to identify service delivery methods which optimize the human computer interface. Controllers from the Air Traffic Data Link Validation Team participated in this study. Author

N91-27405# North Carolina Univ., Chapel Hill. Dept. of Statistics.
CAPACITY OF THE INDEPENDENT INCREMENT NOISE CHANNEL
Michael R. Frey 30 Oct. 1990 28 p
(Contracts N00014-86-K-0039; DAAL03-86-G-0022; NSF NCR-87-13726)
(AD-A235545; LISS-44) Avail: NTIS HC/MF A03 CSCL 20/3

A communications channel model with additive, independent increment, stochastically continuous noise is presented. The information capacity of this channel is obtained for a mean square constraint imposed on the generalized intensity of the channel encoder. The capacity is derived by exploiting the Levy decomposition of the noise to decompose the channel into a white Gaussian noise channel in parallel with a marked Poisson channel. The information capacity is then obtained using results for these latter channels. In particular, recent results for the Poisson channel with mean square constrained encoder intensity are exploited. Although only the channel without feedback is explicitly addressed, the results are also seen to be applicable in the presence of delayed causal feedback. GRA

N91-27406# North Carolina Univ., Chapel Hill. Dept. of Statistics.
CAPACITIES OF THE MEAN-SQUARE-CONSTRAINED POISSON CHANNEL
Michael R. Frey 4 Jul. 1990 14 p
(Contracts N00014-86-K-0039; DAAL03-86-G-0022; NSF NCR-87-13726)
(AD-A235546; LISS-45) Avail: NTIS HC/MF A03 CSCL 12/3

An earlier discussion of the capacity of the mean square constrained Poisson channel is continued. Using a theorem of Hoefding, it is shown that the channel information capacity is the same with or without an on-off keying (OOK) constraint on the channel encoder intensity, affirmatively resolving the conjecture made in the earlier discussion. Thus the known formula for the information capacity of the OOK-constrained channel applies as well in the absence of an OOK constraint. Adapting arguments used by Wyner to address the peak-constrained Poisson channel, it is also shown that the coding capacity with no OOK constraint is equal to the corresponding information capacity. This establishes that all four capacities (coding and information, with and without OOK-constrained encoder) are equal. GRA

N91-27407# Lowell Univ., MA. Center for Atmospheric Research.
A HIGH RESOLUTION STATISTICAL CHARACTERIZATION OF FADING ON METEOR COMMUNICATION CHANNELS
Jay A. Weitzen, Jens C. Ostergaard, and Siu W. Li Nov. 1990 34 p
(Contract F19628-88-K-0004)
(AD-A235548; ULRF-469/CAR; GL-TR-90-0329) Avail: NTIS HC/MF A03 CSCL 20/14

A second part is described of statistical study of fading on meteor communication channels based on data obtained from the Geophysics Laboratory's High Latitude Meteor Scatter Test Bed. In this experiment the sampling rate is increased from 100 Hz to 2000 Hz to provide resolution of 0.5 ms. Trails at 45 MHz from both the Sondrestrom Thule, and Sondrestrom Narsarsuaq links are considered. Trails are classified as underdense or overdense using a modified version of the GL automatic classification routine. Trails are then analyzed for fades with depths exceeding 3,6, and 9 dB relative to a 10 dB Signal-to-Noise threshold. Signal-to-noise ratios are considered relative to bandwidths which vary from 4.8 kHz to 128 kHz. Statistics are computed as a function of frequency, time of day, and trail type for the first D seconds of a trail, where D = 50, 100, 200, 400, and 600 ms. The experiment considers fades with 1 ms minimum duration with a resolution of 0.5 ms. GRA

N91-27408# Massachusetts Inst. of Tech., Cambridge. Research Lab. of Electronics.
NUMERICAL AND SYMBOLIC SIGNAL REPRESENTATION AND PROCESSING Annual Report, 1 Apr. 1990 - 31 Mar. 1991
Alan Oppenheim 3 May 1991 6 p
(Contract N00014-89-J-1489)
(AD-A235621) Avail: NTIS HC/MF A02 CSCL 12/1

During the period of April 1, 1990, through March 31, 1991, our research activities focussed on continuing work on symbolic signal processing, new algorithms for signal analysis, and new signal representations based on wavelet analysis. Our work on this contract during the past year has been reported in detail in the technical literature through technical reports, conference proceedings, and journal articles. Copies of these reports have been provided to the contract monitor and other offices as specified in the contract. Additional copies are available on request. GRA

N91-27409# Colsa, Inc., Huntsville, AL.
OPTICAL PROCESSOR EVALUATION Final Report, Jan. - Nov. 1990
Stephen T. Welstead Mar. 1991 36 p
(Contract F30602-88-D-0028)
(AD-A235690; RL-TR-91-34) Avail: NTIS HC/MF A03 CSCL 09/5

Several different algorithms are evaluated for use in a hybrid electro-optical signal processor. The processor is intended to perform adaptive interference cancellation in radar systems. A personal computer is used to take in an optically formed correlation signal, and compute delays and weights which are used to optically form an estimate of the interfering signal. The algorithm that will reside within the personal computer to accomplish this task is examined. The algorithms considered include parabolic interpolation, steepest descent, conjugate direction, simulated annealing, and two neural network approaches. Relative advantages and disadvantages of each algorithm are discussed. GRA

N91-27410# Naval Research Lab., Washington, DC.
IMPULSE ARRAYS Interim Report
C. L. Temes 3 May 1991 31 p
(NR Proj. RR1-2132)
(AD-A235799; NRL-9303) Avail: NTIS HC/MF A03 CSCL 17/9

This report considers impulse radar signals in terms of their propagation from an array of elements. The far-field electric vector is proportional to the derivative of the current in an infinitesimal dipole representing each element. Although not physically realizable, this model is used as an approximation to illustrate some array properties peculiar to impulse, or ultra-wideband (UWB), excitations. Thus, for example, a 1-ns rounded baseband pulse with a cosine-squared shape theoretically propagates as a single sinusoidal cycle centered at L-band (1 GHz) with 100 percent bandwidth. The far field from an array of elements is considered as a function of angle. GRA

N91-27411# Human Engineering Labs., Aberdeen Proving Ground, MD.
THE EFFECTS OF USER'S TRAINING ON THE PERFORMANCE OF AN AUTOMATIC SPEECH RECOGNIZER FOR A SELF-PACED TASK Final Report
Christopher C. Smyth Apr. 1991 84 p
(DA Proj. 1L1-62716-AH-70)
(AD-A235844; HEL-TM-10-91) Avail: NTIS HC/MF A05 CSCL 25/4

The results of a recent experiment concerning the effects of training on the performance of subjects using the automatic speech recognizer are reported. Over a 5-day period, 20 military enlisted grade male subjects were trained and tested in using a connected speech (speaker-dependent) machine automatic speech recognizer in a self-paced task controlling a generic tactical display by voice command. Experimental results show that a majority of the subjects had little difficulty with the automatic speech recognizer and that for these subjects training produced only a slight improvement in recognizer performance. These subjects performed at a high machine recognition rate. However, during the first session, a large minority (35 percent) of the subjects had difficulty training their speech to be machine recognizable. These subjects required at least two training sessions to perform the task at their best ability, and even after they were trained, their performance never reached the performance level of other subjects. GRA

N91-27412# Cree Research, Inc., Durham, NC.
DEVELOPMENT AND TESTING OF RADIATION AND ELECTROMAGNETIC PULSE HARDENED SILICON CARBIDE BASED ELECTRONICS Quarterly Report, 1 Dec. 1990 - 28 Feb. 1991
J. A. Edmond and J. W. Palmour 30 Apr. 1991 13 p
(Contract N00014-90-C-0037)
(AD-A235888; TR-911008-1) Avail: NTIS HC/MF A03 CSCL 09/1

There were three primary objectives for this reporting period. The first was to electrically characterize junction diodes as a function of temperature. This included both current-voltage (I-V) and capacitance-voltage (C-V) measurements. The second was to fabricate low (about 125 V) and medium (about 450 V) voltage p-n junction rectifiers for neutron and gamma exposure tests. The third objective was to fabricate JFET devices with reduced gate and drain leakage currents than those discussed in the previous report and to package these devices in preparation for radiation testing. GRA

N91-27413# Massachusetts Inst. of Tech., Lexington. Lincoln Lab.
TERMINAL DOPPLER WEATHER RADAR OPERATIONAL TEST AND EVALUATION, ORLANDO 1990
David M. Bernella 9 Apr. 1991 107 p
(Contracts F19628-90-C-0002; DTFA01-L-83-4-10579)
(AD-A236108; ATC-179) Avail: NTIS HC/MF A06 CSCL 17/9

Lincoln Laboratory conducted an evaluation of the Federal Aviation Administration (FAA) Terminal Doppler Weather Radar (TDWR) system in Orlando, Florida during the summer of 1990. In previous years, evaluations have been conducted at airports in Kansas City, MO (1989) and Denver, CO (1988). Since the testing at the Kansas City International Airport, the radar was modified to operate in C-band, which is the intended frequency band for the production TDWR systems. The objectives of the 1990 evaluation period were to evaluate TDWR system performance in detecting low-altitude wind shear, specifically microbursts and gust fronts, at the Orlando International Airport and in the surrounding area; to refine the system's wind shear detection capabilities; and to evaluate elements of the system developed by the contractor, which were new for the C-band system and therefore not available for evaluation in previous years. Some performance comparisons are made among results from the vastly different weather environments of Denver, Kansas City, and Orlando. Statistics are presented and discussed for the performance of the system in detecting and predicting microbursts and gust fronts. A significant use of the prediction capability is its potential use for air traffic control (ATC) personnel to plan airport operations when hazardous weather is predicted. Issues such as low velocity ground clutter (from tree leaves, road traffic, and dense urban areas) that affect prediction performance are discussed along with possible software modification to account for them. GRA

N91-27414# Environmental Research Inst. of Michigan, Ann Arbor. Advanced Concepts Div.
ERIM PROCESSING AND ANALYSIS ACTIVITIES Final Report, Apr. 1990 - Mar. 1991
J. D. Lyden, R. A. Shuchman, and C. C. Wackerman May 1991 10 p
(Contract N00014-90-C-0117)
(AD-A236206; ERIM-226900-5-F) Avail: NTIS HC/MF A02 CSCL 17/9

Several activities were conducted over the past year in support of the P-3/SAR system. Recall that the P-3/SAR is a three-frequency Synthetic Aperture Radar (SAR) which was

developed at the Environmental Research Institute of Michigan (ERIM) and is housed in a Naval Air Development Center (NADC) P-3 aircraft. These activities include: quick-look optical and digital processing, near-term digital analysis, processor upgrades for non-conventional SAR modes, and deployment of a calibration array. Each of these activities were in support of a classified data collection experiment conducted in May/June 1990 by the P-3/SAR and are described below. In addition to the activities listed above, ERIM scientists also played a key role in both the design and execution of last year's test. Finally, this contract has supported the participation of an ERIM scientist on a advisory panel established by the Navy. These activities will also be described below in the document. GRA

N91-27415# Dartmouth Coll., Hanover, NH. School of Engineering.
THE 5/15 GHz SCATTERING STUDY Final Report, Jun. 1988 - Aug. 1989
Robert K. Crane May 1991 75 p
(Contract F30602-88-D-0027)
(AD-A236350; RL-TR-91-45) Avail: NTIS HC/MF A04 CSCL 20/14

Received signal level and multipath delay spread measurements were made at 5 and 16 GHz on a 161 km tropospheric scatter path over moderately rough terrain from Prospect Hill in Waltham, MA to Mt. Tug in Lebanon, NH. The measurement campaign spanned the summer months of May through Aug. 1989. The signal level data were processed to obtain hourly median values for the estimation of the cumulative distribution function (cdf) of received signal level for use in troposcatter communication system design. Multipath delay spread observations were made at the higher frequency. These data were also processed to obtain the sample cdf of the hourly median values of the two sigma multipath delay spread estimates. GRA

N91-27416# Hazeltine Corp., Greenlawn, NY.
INVESTIGATION OF A MULTIFREQUENCY RECONFIGURABLE PHASED ARRAY ANTENNA Final Report, Oct. 1988 - Sep. 1990
John F. Pedersen and Allan Gayer May 1991 173 p
(Contract F19628-87-C-0096)
(AD-A236422; RL-TR-91-42) Avail: NTIS HC/MF A08 CSCL 09/1

The Government has a future requirement to operate several systems simultaneously from a common aperture. A technique has been studied to accomplish this objective by using a control circuit behind each element of the array. The control circuit consists of an arrangement of filters, an attenuator, and a phase shifter. The filters are used to partition the reconfigurable aperture into several simultaneously operating antennas. The attenuator provides independent illumination control while the phase shifters are used to scan individual antenna beams. A laboratory model of a reconfigurable array was designed, fabricated, and tested. The results show that the proposed control circuit provides the desired aspects of reconfigurability. GRA

N91-27417# Physics and Electronics Lab. TNO, The Hague (Netherlands).
CIVIL AND MILITARY SATELLITE COMMUNICATIONS: A SYSTEMS OVERVIEW AND THE FUTURE DEVELOPMENTS Interim Report
J. P. Dezaire Feb. 1991 135 p
(AD-A236441; FEL-90-A338; TDCK-TD90-4049) Avail: NTIS HC/MF A07 CSCL 25/5

The project A90KM616, Orientatie SATCOM, is being performed on behalf of the Royal Netherlands Navy (RNLN) to assist the Navy on the subject of satellite communications. An overview is given of the phenomenon satellite communication. The result is a general overview of satellite communications for both civil and military applications. Some examples of applications are; international telephony, television broadcasting, small private business networks, and mobile (at the moment still principally maritime) communications. In these applications satellite communication systems provide a global coverage and a high flexibility. The scientific articles have not been considered because in this stage it was the intention to study on a specialist level the broad area of techniques. Magazines, books, and a number of reports of universities and research institutes have been the main sources of information. They provided afforded an understanding of the existing systems and insight in the future developments. GRA

N91-27418# Physics and Electronics Lab. TNO, The Hague (Netherlands).
VALIDATION OF DIFFRACTION THEORY BY MEANS OF EXTENSIVE MEASUREMENTS, PART 1 Final Report
J. F. Koppelmans Apr. 1991 71 p
(AD-A236480; FEL-91-B043-Pt-1; TDCK-TD91-0983-Pt-1) Avail: NTIS HC/MF A04 CSCL 17/9

In the FEL computer model the radar cross section of arbitrary objects is calculated by applying geometrical optics and physical optics. In order to perform the computations more accurately, the model also accounts for diffraction phenomena. A large number of measurements and simulations carried out to validate the diffraction theory implemented is presented. During the analysis of the results, it turned out that there was a large difference between measurements using horizontal polarization and those using vertical polarization. At vertical polarization the measurements and simulations generally showed good agreements. At horizontal polarization, however, large differences between the measurements and the simulations occurred. Further analysis showed that these differences were most likely due to the fact that the implemented diffraction theory does not account for multiple diffraction. Apart from that, the anechoic chamber caused problems because of its relatively high clutter level, which was in the same order of magnitude as the measured signals. For further validation efforts, it is therefore recommended to include multiple diffraction in the computer model and to perform new measurements under more controlled conditions. GRA

N91-27419# Massachusetts Inst. of Tech., Lexington. Lincoln Lab.
HIGH RESOLUTION MICROBURST OUTFLOW VERTICAL PROFILE DATA FROM HUNTSVILLE, ALABAMA, AND DENVER, COLORADO
P. J. Biron and M. A. Isaminger 10 Apr. 1991 214 p
(Contract DTFA01-L-83-4-10579)
(AD-A236486; DOD/FAA/PS-88-17) Avail: NTIS HC/MF A10 CSCL 17/9

Detailed data is presented on microburst outflows recorded by the TDWR testbed radar (FL-2). Whenever possible, a microburst detected within 10 km of the radar was scanned in a vertical direction (RHI) at 1 to 2 degree azimuthal intervals about the center of divergence. The vertical profile of the outflow is pertinent to the detection capability and siting strategy of a single Doppler radar observing the microburst from a horizontal viewing angle. Additionally, outflow features are important in assessing the hazard associated with microbursts as well as the capability of other wind shear detection (LLWAS or ASR). Of particular interest is the variability of outflow depths from case to case and site to site. If the depth across the maximum velocity differential is shallow, an outflow might go undetected or underestimated by a radar, the beam of which was not viewing the axis of peak divergence. Previous research projects in Denver reported the highest winds in a microburst typically occur near the surface with an average outflow depth (1/2 peak velocity) ranging between 500 and 600 meters; however, the vertical resolution of these data was fairly crude due to the scan strategies utilized. Detailed high resolution microburst outflow vertical profile data is provided which is pertinent to TDWR system studies based on RHI and closely spaced PPI scans. GRA

N91-27420# Georgia Inst. of Tech., Atlanta.
EVALUATION OF SLOT ALLOCATION STRATEGIES FOR TDMA PROTOCOLS IN PACKET RADIO NETWORKS
David S. Stevens and Mostafa H. Ammar 24 Jan. 1991 36 p

(Grant NSF NCR-68-04850)
(AD-A236518; AIRMICS-ASQB-GI-90-022) Avail: NTIS HC/MF A03 CSCL 25/2

This paper examines the delay performance of packet radio networks using a time division multiple access (TDMA) channel access protocol. Two different methodologies for assigning time slots to nodes are considered - Node and Link allocation. The performance of each strategy is evaluated using a detailed radio network simulation. In addition to the delay for single destination packets, two broadcast protocols are used - multidestination routing and flooding. In all cases it was found that Node allocation provides better delay performance than Link allocation. GRA

N91-27421# University of Southern California, Marina del Rey. Information Sciences Inst.
NETWORK COMMUNICATIONS RESEARCH Final Technical Report, Nov. 1987 - Oct. 1990
J. Postel, C. Anderson, R. Braden, S. Casner, and G. Finn Dec. 1990 49 p
(Contract DMA903-87-C-0719; ARPA Order 6180)
(AD-A236542) Avail: NTIS HC/MF A03 CSCL 25/5

This report summarizes work performed in the area of network communication research. This effort was divided into four projects: (1) the Internet Concepts Project; (2) the Multimedia Conferencing Project; (3) the Protocol Accelerator project; and (4) the Supercomputer and Workstation Communication Project. Under these projects, ISI research staff engaged in research into packet communication technologies, including, but not limited to, combinations of broadband satellite, internet protocols, and routing algorithms to assess their applicability to generic military command and control problems. Command and control system architectures for utilizing geographically distributed processing capabilities such as mixed voice, data and graphics conferencing, electronic message handling, and other applications were investigated, tested, and evaluated. GRA

N91-27422# Physics and Electronics Lab. TNO, The Hague (Netherlands).
FAST DETERMINATION OF THE ELEMENT EXCITATION OF AN ACTIVE PHASED ARRAY ANTENNA
J. G. VanHezewijk Mar. 1991 19 p
(AD-A236545; FEL-91-B038) Avail: NTIS HC/MF A03 CSCL 09/1

The far field radiation pattern of an active phased array antenna is determined by the excitation of its elements. The amplitude and phase of this excitation can be adjusted in an active phased array and have to be properly set in order to obtain a desired far field pattern. This report describes a fast and easy method to determine this element excitation: the electric field in terms of amplitude and phase has to be measured in only one direction of interest of the far field of the antenna as a function of the element's amplitude and phase settings. The method is called the Element Excitation Method (EEM). Both theoretical and practical aspects can be found in this report. The method proved to be very useful in the alignment of the amplitude and phase settings of the elements of an active phased array at C-band. GRA

N91-27423# Naval Ocean Systems Center, San Diego, CA.
OBSERVATIONS OF ELF SIGNATURES ARISING FROM SPACE VEHICLE DISTURBANCES OF THE IONOSPHERE
J. Y. Dea, W. VanBise, E. A. Rauscher, and W.-M. Boerner May 1991 37 p
(AD-A236563) Avail: NTIS HC/MF A03 CSCL 20/14

We report on observations of Extremely Low Frequency (ELF) signatures during exit or reentry of space vehicles through the ionosphere. The two modes regularly observed gave signals that peaked at 5.6 Hz and 11.2 Hz. The evidence points to the lower ionosphere, i.e., the D- and E-layers, as the generator of these signals. The measurements were performed using ground-based multiturn coil sensors located in Reno and San Diego. The nature of these signals is unclear at present but it is surmised that we are detecting either the evanescent fields of hydromagnetic waves traveling in the ionosphere or the oscillating geomagnetic field associated with these hydromagnetic waves. GRA

N91-27424# Massachusetts Inst. of Tech., Lexington. Lincoln Lab.
LOGICAL IMPLEMENTATION OF THE AUTOMATIC TARGET RECOGNITION WORKING GROUP (ATRWG) 9-TRACK TAPE FORMAT IMAGE STORAGE FORMAT
P. J. Kolodzy and J. E. Baum 9 Apr. 1991 20 p
(Contract F19628-90-C-0002)
(AD-A236627; TR-920; ESD-TR-91-057) Avail: NTIS HC/MF A03 CSCL 12/5

Over the past two years, the Opto-Radar Systems Group has spearheaded the effort to select and incorporate a standard file format for raw sensor imagery. The goal is to use only one format for the multiple computing facilities and thus eliminate the problem of individual users creating custom software. Such a format must include all the header information that existed on the original data tapes, so all the available sensor information is retained. The format selected, called the NATO format within the Opto-Radar Systems Group, is a subset of the NATO data format developed by the Automatic Target Recognition Working Group (ATRWG). This format is apparently widely used in the ATR community. Thus, an additional benefit to such a format is the ability to transport data to and from other ATR facilities. GRA

N91-27425# Naval Research Lab., Washington, DC.
CLUTTER-DOPPLER SPECTRAL ANALYSIS FOR A SPACE-BASED RADAR Final Report
Eric L. Mokole 10 May 1991 43 p
(AD-A236644; NRL-9327) Avail: NTIS HC/MF A03 CSCL 17/9

The impact of worst-case, ionospheric scintillation on the clutter-Doppler spectrum is analyzed for a space-based radar that operates between 100 and 1300 MHz. Analytical expressions for the spectrum are derived for a narrow, Gaussian antenna beam. For normal system parameters, the analytical expressions, combined with data from the Defense Nuclear Agency's Wideband satellite experiment, are used to compare the relative significance of the components of the clutter-Doppler spread for a range cell and to obtain the clutter-Doppler spread over the antenna's mainlobe. In addition, lower bounds are determined on the achievable reduction in the clutter-Doppler spread of a system. GRA

N91-27426# Pennsylvania Univ., Philadelphia. Dept. of Electrical Engineering.
ADAPTIVE BEAMFORMING ALGORITHMS FOR HIGH RESOLUTION MICROWAVE IMAGING, VOLUME 1 Final Report, Sep. 1987 - Feb. 1990
Bernard D. Steinberg and Boogsoon Kang Apr. 1991 149 p
(Contract F30602-88-D-0025)
(AD-A236648; RL-TR-91-57-Vol-1) Avail: NTIS HC/MF A07 CSCL 17/9

Two types of algorithms for self calibrating distorted antenna arrays are presented and evaluated. Both successfully convert badly distorted phased arrays into diffraction-limited systems. One group is called the dominant scatterer class; each of the several algorithms in this class develops a correction weight vector from the radar echoes of one or more scatterers having large radar cross section. The second is the spatial correlation class. This group of algorithms determines the weight vector from the spatial correlation function of the measured radiation field from targets and clutter. Tests are conducted with simulation and with high resolution radar data of airborne and ground based targets. The spatial correlation algorithms are less sensitive to the source distribution (targets and clutter locations) and therefore are preferred for a general radar environment. These algorithms require more computation than those based upon dominant scatterers. Relative computation times are measured and presented. GRA

N91-27427# Army Information Systems Command, Fort Huachua, AZ.
A DISTRIBUTED TDMA RESCHEDULING PROCEDURE FOR MOBILE PACKET RADIO NETWORKS
David S. Stevens and Mostafa H. Ammar Jan. 1991 30 p
(AD-A236656; USAISEC-ASQB-GI-91-008) Avail: NTIS HC/MF A03 CSCL 25/2

Packet radio networks provide two features not present in a wire-based network - mobility and a broadcast channel. Time Division Multiple Access (TDMA) protocols provide packet radio networks with two features that facilitate efficient communications. First, they eliminate the possibility of collisions on the broadcast channel. Second, they allow for the spatial reuse of the radio channel bandwidth by permitting more than one node to transmit at once. However, the goal of maximizing the use of the bandwidth seems to conflict with the goal of allowing mobile nodes to locally reallocate themselves TDMA slots so that collisions will not occur. We present a procedure that permits a node to move and then reallocate itself a transmission slot without involving the entire network. In our procedures the channel over which control packets are exchanged is shared and unreliable. Therefore the resulting TDMA schedule may not be collision free. We present a collision resolution algorithm to correct these problems. Finally a procedure by which nodes can allocate themselves additional transmission slots, if they are available and which maximizes bandwidth utilization, is given. GRA

N91-27428# Politecnico di Torino (Italy). Dept. di Elettronica
APPLICATIONS OF SIGNAL PROCESSING IN DIGITAL COMMUNICATIONS Final Technical Report, 1987 - 1990
Michele Elia Apr. 1991 36 p
(Contract DAJA45-86-C-0044)
(AD-A236740; R/D-5228-CC-01) Avail: NTIS HC/MF A03 CSCL 25/5

The general considerations are summarized on the design of signal sets and coding schemes. The aim is to provide a set of rules that are behind an efficient use of the transmission resources. The basis signal design, point constellations, combined coding/modulation, and concatenation of codes are discussed, which appear to be the present day qualified artifices that exchange complexity for bandwidth, transmission rate and power. GRA

N91-27429# Army Missile Command, Redstone Arsenal, AL. Advanced Sensors Directorate.
A SURVEY OF ANALOG-TO-DIGITAL CONVERTER TECHNOLOGY FOR RADAR APPLICATIONS Final Technical Report, for period ending Mar. 1991
Robert C. Hicks May 1991 15 p
(AD-A236749; AD-E951659; AMSMI/TR-RD-AS-91-13) Avail: NTIS HC/MF A03 CSCL 12/6

A survey of state-of-the-art analog-to-digital converters (ADCs) was conducted in 1990. The sampling rates are compared for ADCs that have been six to eighteen bits of resolution. These ADCs are graphically compared to the best ADCs of 1978 and 1981 as well as to the ADCs expected in 1992. This helps quantify the rate of progress of ADC technology. GRA

N91-27430# Massachusetts Inst. of Tech., Lexington. Lincoln Lab.
PASSIVE EQUALIZATION OF WIDEBAND COMMUNICATION SYSTEMS
Mark L. Stevens 22 Mar. 1991 53 p
(Contract F19628-90-C-0002)
(AD-A236813; TR-909; ESD-TR-90-146) Avail: NTIS HC/MF A04 CSCL 25/5

This report describes a technique that produces high-performance passive equalization networks for wideband communication systems. The relationship between the time-domain and frequency-domain performance of a simple but important class of networks is derived. The results of this analysis provide an estimate of the precision of equalization required in the frequency domain, given the requirements for waveform quality in the time domain. The effects of equalization magnitude and phase errors on a system transfer function are described, and the optimum weighting function for the least-mean-square-error minimization of magnitude and phase errors is derived. An example is given of the baseband equalization of a 220-Mbit/sec 4-ary FSK optical communication system. High-quality equalization is achieved using this technique over a frequency range of DC to approximately 1 GHz using simple, economical networks. Appendices are provided, describing the APL computer functions that were written to optimize and synthesize the filter hardware. GRA

N91-27431# Naval Postgraduate School, Monterey, CA.
REAL-TIME MULTI-FREQUENCY MODULATION USING DIFFERENTIALLY-ENCODED SIGNAL CONSTELLATIONS M.S. Thesis
Peter G. Basil Jun. 1990 79 p
(AD-A236839) Avail: NTIS HC/MF A05 CSCL 25/5

This report discusses advances in the development of a multi-frequency modulation (MFM) packet communications system on an industry standard computer. Transmitter and receiver programs are described that control vector signal processors and data acquisition devices. Further, these programs encode, modulate, demodulate, and decode the MFM signal. The throughput data rate was doubled, the encoding/decoding process was implemented in near real-time, and a personal computer plug-in board was designed and built to provide synchronization between the transmitter and receiver. This MFM implementation provided acceptable bit error rates at input signal-to-noise ratios of 15 dB and above. GRA

N91-27432# North Carolina Univ., Chapel Hill. Dept. of Statistics.
INFORMATION CAPACITY OF THE MATCHED GAUSSIAN CHANNEL WITH JAMMING. PART 2: INFINITE-DIMENSIONAL CHANNELS
C. R. Baker and I. F. Chao Oct. 1990 19 p
(Contract N00014-89-J-1175)
(AD-A236847) Avail: NTIS HC/MF A03 CSCL 17/4

The additive infinite-dimensional Gaussian channel subject to jamming is modeled as a two-person zero-sum game with mutual information as the payoff function. The jammer's noise is added to the ambient Gaussian noise. The coder's signal energy is subject to a constraint is necessary in order that the capacity without feedback be finite. It is shown that use of this same RKHS constraint on the jammer's process is too strong; the jammer would then not be able to reduce capacity, regardless of the amount of jamming energy available. The constraint on the jammer is thus on the total jamming energy, without regard to its distribution relative to that of the ambient noise energy. The existence of a saddle value for the problem does not follow from the von Neuman minimax theorem in the original problem formulation. However, a solution is shown to exist. A saddle point, saddle value, and the jammer's minimax strategy are determined. The solution is a function of the problem parameters: the constraint on the coder, the constraint on the jammer, and the covariance of the ambient Gaussian noise. GRA

N91-27433# Naval Postgraduate School, Monterey, CA.
EXPERIMENTAL INVESTIGATION OF A mm-WAVE PLANAR ANTENNA M.S. Thesis
Georgios D. Lambrakakis Jun. 1990 137 p
(AD-A236934) Avail: NTIS HC/MF A07 CSCL 09/1

This thesis investigates a new mm-wave Bilateral Slot Line (BSL) antenna and its relation to the Linearly Tapered Slot Antenna (LTSA). The BSL antenna consists of a tapered double-sided slotline and can be viewed as two identical LTSAs sandwiched back to back. Dielectric substrates with permittivities of 2.33 and 6.0 were used to construct these antennas. The theoretical background, the design, and the performance in the frequency range 5 to 9 GHz of the new microwave integrated circuit antenna is presented. The effects of several parameters such as dielectric constant, stripline and slotline characteristic impedance, antenna structure, and transition scheme on the radiation patterns and return loss were experimentally investigated. Some relationships

between the width of stripline and slotline, their characteristic impedance and the dielectric constant are reported. Guidelines are laid to design the LTSA and BSL antennas. Author (GRA)

N91-27434# Naval Postgraduate School, Monterey, CA.
ELECTRONIC COMMUNICATIONS SYSTEMS AND THE FREQUENCY DOMAIN: AN ILLUSTRATED PRIMER FOR C3 STUDENTS M.S. Thesis
Bruce K. Babcock Jun. 1990 123 p
(AD-A236936) Avail: NTIS HC/MF A06 CSCL 25/2

This thesis is a tutorial for Command, Control, and Communications (C3) students and synthesizes the essence of electronic communications systems and related frequency spectrums into an integrated set of illustrations. The objective is to help the C3 student focus his or her attention on the performed operations and transformations in order to acquires a better understanding for the processes involved. The first major illustration shows how the various components of a communication system are related. These components include analog and digital signals, multiplexing, modulation, and various transmission mediums. Central to any communications system is the limitations imposed by bandwidth and noise. The concept of bandwidth is developed through Fourier analysis. An integrated set of graphics shows the relationship between the time and frequency domains and illustrates how the bandwidth increases as the pulse width decreases. Transmitting information often requires higher data rates which, in turn, require higher frequencies. Radio wave propagation is frequency dependent and a chart is developed showing the different categories of radio wave propagation as they relate to atmospheric layers and frequency. Finally, a chart relating transmission medium attenuation, noise sources, and various radio wave terminology is given. GRA

N91-27435# Naval Postgraduate School, Monterey, CA.
EFFECTS OF NON-UNIFORM WINDOWING IN A RICIAN-FADING CHANNEL AND SIMULATION OF ADAPTIVE AUTOMATIC REPEAT REQUEST PROTOCOLS M.S. Thesis
Chris G. Kmiecik Jun. 1990 66 p
(AD-A236940) Avail: NTIS HC/MF A04 CSCL 25/5

Two aspects of digital communication were investigated. In the first part, a Fast Fourier Transformation (FFT) based, M-ary frequency shift keying (FSK) receiver in a Rician-fading channel was analyzed to determine the benefits of non-uniform windowing of sampled received data. When a frequency offset occurs, non-uniform windowing provided better FFT magnitude separation. The improved dynamic range was balanced against a loss in detectability due to signal attenuation. With large frequency offset, the improved magnitude separation outweighed the loss in detectability. An analysis was carried out to determine what frequency deviation is necessary for non-uniform windowing to out-perform uniform windowing in a slow Rician-fading channel. Having established typical values of probability of bit errors, the second part of this thesis looked at improving throughput in a digital communications network by applying adaptive automatic repeat request (ARQ) protocols. The results of simulations of adaptive ARQ protocols with variable frame lengths is presented. By varying the frame length, improved throughput performance through all bit error rates was achieved. GRA

N91-27436*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, OH.
A THREE-DIMENSIONAL FINITE-ELEMENT THERMAL/MECHANICAL ANALYTICAL TECHNIQUE FOR HIGH-PERFORMANCE TRAVELING WAVE TUBES
Karen F. Bartos, E. Brian Fite, Kurt A. Shalkhauser, and G. Richard Sharp Washington Jun. 1991 17 p Original contains color illustrations
(NASA-TP-3081; E-5917; NAS 1.60:3081) Avail: NTIS HC/MF A03; 5 functional color pages CSCL 09C

Current research in high-efficiency, high-performance traveling wave tubes (TWT's) has led to the development of novel thermal/mechanical computer models for use with helical slow-wave structures. A three-dimensional, finite element computer model and analytical technique used to study the structural integrity and thermal operation of a high-efficiency, diamond-rod, K-band TWT designed for use in advanced space communications systems. This analysis focused on the slow-wave circuit in the radiofrequency section of the TWT, where an inherent localized heating problem existed and where failures were observed during earlier cold compression, or 'coining' fabrication technique that shows great potential for future TWT development efforts. For this analysis, a three-dimensional, finite element model was used along with MARC, a commercially available finite element code, to simulate the fabrication of a diamond-rod TWT. This analysis was conducted by using component and material specifications consistent with actual TWT fabrication and was verified against empirical data. The analysis is nonlinear owing to material plasticity introduced by the forming process and also to geometric nonlinearities presented by the component assembly configuration. The computer model was developed by using the high efficiency, K-band TWT design but is general enough to permit similar analyses to be performed on a wide variety of TWT designs and styles. The results of the TWT operating condition and structural failure mode analysis, as well as a comparison of analytical results to test data are presented. Author

N91-27437*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, OH.
Ka-BAND MMIC MICROSTRIP ARRAY FOR HIGH RATE COMMUNICATIONS
R. Q. Lee, C. A. Raquet, J. B. Tolleson, and S. M. Sanzgiri (Texas Instruments, Inc., McKinney.) 1991 8 p Proposed for presentation at the Conference on Advanced Space Exploration Initiative Technologies, Cleveland, OH, 4-6 Sep. 1991; cosponsored by AIAA and OAI
(NASA-TM-104500; E-6358; NAS 1.15:104500; AIAA-91-3421) Avail: NTIS HC/MF A02 CSCL 17B

In a recent technology assessment of alternative communication systems for the space exploration initiative (SEI), Ka-band (18 to 40 GHz) communication technology was identified to meet the mission requirements of telecommunication, navigation, and information management. Compared to the lower frequency bands, Ka-band antennas offer higher gain and broader bandwidths; thus, they are more suitable for high data rate communications. Over the years, NASA has played an important role in monolithic microwave integrated circuit (MMIC) phased array technology development, and currently, has an ongoing contract with Texas Instrument (TI) to develop a modular Ka-band MMIC microstrip subarray (NAS3-25718). The TI contract emphasizes MMIC integration technology development and stipulates using existing MMIC devices to minimize the array development cost. The objective of this paper is to present array component technologies and integration techniques used to construct the subarray modules. Author

N91-27438# Scientech, Inc., Idaho Falls, ID.
S-76 ROTORCRAFT HIGH INTENSITY RADIATED FIELDS. TEST PLAN
Jerry T. Blair, Steve M. Brooks, and Ken A. Barnes Jul. 1991 71 p Sponsored by FAA
(Contract DE-AC07-90ID-12916)
(SCIE-FAA-001-91; DOT/FAA/CT-TN91/26) Avail: NTIS HC/MF A04

Concern over the effects of High Intensity Radiated Fields (HIRF) on civil and military aircraft has increased over the past 10 years. The increase is due to several factors which affect the safe flight of all fixed-wing and rotorcraft. Previous flight-critical mechanical controls are being replaced by electronic computer-driven controls; manufacturers are increasing the use of composite materials in the fabrication of new aircraft; and frequency ranges and output power levels of commercial and military transmitters have significantly increased. While much HIRF susceptibility information has been collected, the data are proprietary and have not been released. To address the HIRF concerns and begin development of a releasable HIRF data base, the FAA Technical Center, has implemented a HIRF research

program. As part of that program, a HIRF test was performed on a Sikorsky S-76 Helicopter. The purpose, approach, and initial findings of the S-76 HIRF test are addressed. Author

N91-27439* National Aeronautics and Space Administration. Pasadena Office, CA.
MULTIPLE SYMBOL DIFFERENTIAL DETECTION Patent
Dariush Divsalar, inventor (to NASA) and Marvin K. Simon, inventor (to NASA) (Jet Propulsion Lab., California Inst. of Tech., Pasadena.) 21 May 1991 24 p Filed 31 Jul. 1990
(Contract NAS7-918)
(NASA-Case-NPO-17896-1-CU; US-Patent-5,017,883; US-Patent-Appl-SN-560691; US-Patent-Class-329-304; US-Patent-Class-375-53; US-Patent-Class-375-56; US-Patent-Class-375-85; US-Patent-Class-375-86; Int-Patent-Class-H04L-27/22) Avail: US Patent and Trademark Office CSCL 17B

A differential detection technique for multiple phase shift keying (MPSK) signals is provided which uses a multiple symbol observation interval on the basis of which a joint decision is made regarding the phase of the received symbols. In accordance with the invention, a first difference phase is created between first and second received symbols. Next, the first difference phase is correlated with the possible values thereof to provide a first plurality of intermediate output signals. A second difference phase is next created between second and third received symbols. The second difference phase is correlated with plural possible values thereof to provide a second plurality of intermediate output signals. Next, a third difference phase is created between the first and third symbols. The third difference phase is correlated with plural possible values thereof to provide a third plurality of intermediate output signals. Each of the first plurality of intermediate outputs are combined with each of the second plurality of intermediate outputs and each of the third plurality of intermediate outputs to provide a plurality of possible output values. Finally, a joint decision is made by choosing from the plurality of possible output values the value which represents the best combined correlation of the first, second and third difference values with the possible values thereof.

Official Gazette of the U.S. Patent and Trademark Office

N91-27440*# Arizona State Univ., Tempe. Dept. of Electrical Engineering.
HIGH-FREQUENCY TECHNIQUES FOR RCS PREDICTION OF PLATE GEOMETRIES Semiannual Progress Report, 1 Feb. - 31 Jul. 1991
Constantine A. Balanis and Lesley A. Polka 31 Jul. 1991 38 p
(Grant NAG1-562)
Avail: NTIS HC/MF A03 CSCL 20N

Radar cross section (RCS) prediction of several rectangular plate geometries is discussed using high-frequency techniques such as the Uniform Theory of Diffraction (UTD) for perfectly conducting and impedance wedges and the Method of Equivalent Currents (MEC). Previous reports have presented detailed solutions to the principal-plane scattering by a perfectly conducting and a coated rectangular plate and nonprincipal-plane scattering by a perfectly conducting plate. These solutions are briefly reviewed and a modified model is presented for the coated plate. Theoretical and experimental data are presented for the perfectly conducting geometries. Agreement between theory and experiment is very good near and at normal incidence. In regions near and at grazing incidence, the disagreement between the data vary according to diffraction distances and angles involved. It is these areas of disagreement which are of extreme interest as an explanation for the disagreement will yield invaluable insight into scattering mechanisms which are not yet identified as major contributors near and at grazing incidence. Areas of disagreement between theory and experiment are identified and examined in an attempt to better understand and predict near-grazing incidence, grazing incidence, and nonprincipal-plane diffractions. Author

N91-28105*# Alabama A & M Univ., Normal. School of Engineering and Technology.
AEROSOL SPECKLE EFFECTS ON ATMOSPHERIC PULSED LIDAR BACKSCATTERED SIGNALS
S. R. Murty *In* Alabama A & M Univ., NASA-HBCU Space Science and Engineering Research Forum Proceedings 1989 p 304-31 (For primary document see N91-28063 19-99)
(Grant NsG-8037)
Avail: NTIS HC/MF A23 CSCL 20N

33 ELECTRONICS AND ELECTRICAL ENGINEERING

Includes test equipment and maintainability; components, e.g., tunnel diodes and transistors; microminiaturization; and integrated circuitry.

For related information see also *60 Computer Operations and Hardware* and *76 Solid-State Physics.*

N91-27441# Joint Publications Research Service, Arlington, VA.
JPRS REPORT: SCIENCE AND TECHNOLOGY. USSR: ELECTRONICS AND ELECTRICAL ENGINEERING
24 Oct. 1990 75 p Transl. into ENGLISH from various Russian articles
(JPRS-UEE-90-011) Avail: NTIS HC/MF A04

Abstracts of articles relative to U.S.S.R. research in electronics and electrical engineering are given. Subjects covered include broadcasting, consumer electronics, antennas, wave propagation, transportation, control instrumentation, industrial electronics, computers, power engineering, quantum electronics, electro-optics, and solid state circuits. Author

N91-27442 Department of the Navy, Washington, DC.
RF LOCKOUT CIRCUIT FOR ELECTRONIC LOCKING SYSTEM Patent
Earl M. Becker, Jr., inventor (to Navy) and Allen Miller, inventor (to Navy) 26 Feb. 1991 8 p Filed 24 Nov. 1989
(AD-D014887; US-Patent-4,996,525; US-Patent-Appl-SN-440950; US-Patent-Class-340-825.3) Avail: US Patent and Trademark Office CSCL 25/2

An electronics lockout circuit was invented that includes an antenna adapted to receive radio frequency signals from a transmitter, and a radio frequency detector circuit which converts the radio frequency signals into a first direct current voltage indicative of the relative strength of the field resulting from the radio frequency signals. The first direct current voltage is supplied to a trigger circuit which compares this direct current voltage to an adjustable direct current reference voltage. This provides a second direct current voltage at the output whenever the amplitude of the first direct current voltage exceeds the amplitude of the reference voltage provided by the comparator circuit. This is supplied to a disconnect relay circuit which, upon receiving a signal from the electronic control unit of an electronic combination lock during the time period at which the second direct current voltage is present, isolates the door strike coil of a security door from the electronic control unit. This prevents signals falsely generated by the electronic control unit because of radio frequency signals in the vicinity of the electronic control unit energizing the door strike coil and accidentally opening a security door. GRA

N91-27443# Lawrence Livermore National Lab., CA.
NONEQUILIBRIUM SIMULATION OF THE COMMUTATION PHASE IN A BACK-LIT THYRATRON
B. M. Penetrante and J. N. Bardsley 1 Feb. 1991 4 p Presented at the 20th International Conference on Phenomena in Ionized Gases, Barga (Italy), 8-12 Jul. 1991
(Contract W-7405-eng-48)
(DE91-010471; UCRL-JC-106474; CONF-910711-2) Avail: NTIS HC/MF A01

The operating cycle of thyratrons and related switches can be divided into four phases: voltage hold-off, commutation, conduction, and recovery. In this paper a computer simulation of the

commutation phase of a back-lit thyratron (BLT) is presented. The BLT consists of opposing hollow cylindrical electrodes with an axial hole. Triggering is accomplished by illuminating the back side of the hollow cathode with UV light and generating photoelectrons. The operating characteristics of the BLT have been experimentally investigated by Kirkman and Gundersen, Kirkman et. al., and Harmann et. al. Several models have been developed independently to study the early stages in the formation of the high current discharge in BLT and related pseudopark switches. Hopefully in the near future the merits of these models, including the one presented here, will be benchmarked with experimental data for the same set of physical parameters. In the meantime these models have been useful in the understanding various physics features in the operation of these switches. DOE

N91-27444*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, OH.
ELECTRICAL CHARACTERIZATION OF GLASS, TEFLON, AND TANTALUM CAPACITORS AT HIGH TEMPERATURES
A. N. Hammoud (Sverdrup Technology, Inc., Brook Park, OH.), E. D. Baumann, I. T. Myers, and E. Overton 1991 8 p Presented at the 1991 Conference on Electrical Insulation and Dielectric Phenomena, Knoxville, TN, 20-24 Oct. 1991; sponsored by IEEE
(NASA-TM-104517; E-6387; NAS 1.15:104517) Avail: NTIS HC/MF A02 CSCL 09C

Dielectric materials and electrical components and devices employed in radiation fields and the space environment are often exposed to elevated temperatures among other things. Therefore, these systems must withstand the high temperature exposure while still providing good electrical and other functional properties. Experiments were carried out to evaluate glass, teflon, and tantalum capacitors for potential use in high temperature applications. The capacitors were characterized in terms of their capacitance and dielectric loss as a function of temperature up to 200 C. At a given temperature, these properties were obtained in a frequency range of 50 Hz to 100 kHz. The DC leakage current measurements were also performed in a temperature range from 20 to 200 C. The obtained results are discussed and conclusions are made concerning the suitability of the capacitors investigated for high temperature applications. Author

N91-27445*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, OH.
DESIGN ASPECTS AND COMPARISON BETWEEN HIGH T(SUB c) SUPERCONDUCTING COPLANAR WAVEGUIDE AND MICROSTRIP LINE
K. S. Kong, K. B. Bhasin, and T. Itoh (California Univ., Los Angeles.) 1991 11 p Presented at the Optical Engineering and Photonics in Aerospace Sensing Symposium, Orlando, FL, 1-5 Apr. 1991; sponsored by International Society for Optical Engineers
(Contracts NCC3-192; N00014-89-J-1006)
(NASA-TM-105142; E-6416; NAS 1.15:105142) Avail: NTIS HC/MF A03 CSCL 09C

The high T sub c superconducting microstrip line and coplanar waveguide are compared in terms of the loss characteristics and the design aspects. The quality factor Q values for each structure are compared in respect to the same characteristic impedance with the comparable dimensions of the center conductor of the coplanar waveguide and the strip of the microstrip line. Also, the advantages and disadvantages for each structure are discussed in respect to passive microwave circuit applications. Author

N91-27446*# Sverdrup Technology, Inc., Brook Park, OH.
ANALOG SYNTHESIZED FAST-VARIABLE LINEAR LOAD Final Report
Janis M. Niedra Jul. 1991 7 p Presented at the 26th Intersociety Energy Conversion Engineering Conference, Boston, MA, 4-9 Aug. 1991; cosponsored by ANS, SAE, ACS, AIAA, ASME, IEEE, and AIChE
(Contract NAS3-25266)
(NASA-CR-187155; E-6377; NAS 1.26:187155) Avail: NTIS HC/MF A02 CSCL 09C

A several kilowatt power level, fast-variable linear resistor was synthesized by using analog components to control the conductance of power MOSFETs. Risetimes observed have been as short as 500 ns with respect to the control signal and 1 to 2 microseconds with respect to the power source voltage. A variant configuration of this load that dissipates a constant power set by a control signal is indicated. Replacement of the MOSFETs by static induction transistors (SITs) to increase power handling, speed and radiation hardness is discussed. Author

N91-27447*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, OH.
RECENT PROGRESS IN InP SOLAR CELL RESEARCH
Irving Weinberg, D. J. Brinker, R. K. Jain, and C. K. Swartz 1991 9 p Presented at the 26th Intersociety Energy Conversion Engineering Conference, Boston, MA, 4-9 Aug. 1991; sponsored by ANS, SAE, ACS, AIAA, ASME, IEEE, and AIChE
(NASA-TM-104509; E-6375; NAS 1.15:104509) Avail: NTIS HC/MF A02 CSCL 10A

Significant new developments in InP solar cell research are reviewed. Recent accomplishments include monolithic multi-bandgap two junction cells (three and two terminal) using InP as the top cell and lattice matched GaInAs and GaInAsP as the bottom, low bandgap component. Concentrator cells include the three terminal multibandgap cell and n + p cell using an InP substrate. The review also includes small scale production of ITO/InP cells and results for n + p InP and ITO/InP cells in space on board the LIPS 3 satellite. Author

N91-27448# Joint Publications Research Service, Arlington, VA.
JPRS REPORT: SCIENCE AND TECHNOLOGY. USSR: ELECTRONICS AND ELECTRICAL ENGINEERING
7 Sep. 1990 38 p Transl. into ENGLISH from various Russian articles
(JPRS-UEE-90-010) Avail: NTIS HC/MF A03

This is a compilation of translated articles from Russian publications. They are divided into the following general classifications: Broadcasting, Consumer Electronics; Antennas, Propagation; Circuits, Systems; Transportation; Industrial Electronics, Control Instrumentation; Power Engineering; Industrial Applications; Quantum Electronics, Electro-Optics; and Solid State Circuits. Some representative titles are: Satellite television: Antennas for 11 to 12 GHz band; Double stimulated scattering of electromagnetic waves in ionospheric plasma; Distribution of fluctuations of spherical waves in far field behind chaotically behaving planar shield; The VL10U electric train: Electrical circuit troubleshooting; Determination of power losses in superconducting devices; and Functional microelectronic devices based on superconducting quantum interferometers. E.R.

N91-27449# Joint Publications Research Service, Arlington, VA.
JPRS REPORT: SCIENCE AND TECHNOLOGY. USSR: ELECTRONICS AND ELECTRICAL ENGINEERING
25 Feb. 1991 37 p Transl. into ENGLISH from various Russian articles
(JPRS-UEE-91-002) Avail: NTIS HC/MF A03

This is a compilation of translated articles from Russian publications. The articles are presented under several general classifications. They are as follow: Broadcasting, Consumer Electronics; Antennas, Propagation; Circuits, Systems; Transportation; Industrial Electronics, Control Instrumentation; and Power Engineering. A representative title from each category is as follows: Computer aided physical modeling and design of VLSI matrix circuit topology; Experimental results of studies of artificial ionospheric turbulence; Algorithm for estimating spatial distribution of velocities in radar watch systems; Principles of constructing comprehensive system for computer aided design of railroad automation and remote control; Automated setting algorithm for the Remmikont R-130 microprocessor controller; and Giant magnetostriction: new possibilities for building electric high torque precision motors and drives. E.R.

N91-27450# Maryland Univ., College Park. Dept. of Electrical Engineering.
PULSE CODED BIOLOGICALLY MOTIVATED NEURAL-TYPE MOS CIRCUITS Semiannual Progress Report No. 3, 1 Nov. 1990 - 1 May 1991
29 Apr. 1991 15 p
(Contract N00014-90-J-1114)
(AD-A235433) Avail: NTIS HC/MF A03 CSCL 09/1

During this period improvements have been made in the pulse coded neuron which realizes all 16 binary valued logic functions of two inputs. Because the original circuit is inconvenient for VLSI, a study has been made of how to delete the filters used in the previously reported neuron. From this we have been led to a new pulse coded neuron which shows promise for realizing any Hopfield type of neural network in the pulse coded framework. At this point the new pulse coded neuron has been shown to allow us to also generate 14 of the 16 binary valued logic functions without the use of the inconvenient filters of the previous pulse coded neuron. Also using the new neuron a two input MAXNET has been realized. A major problem in implementing Hopfield types of neural networks in the pulse coded philosophy is how to encode general weights. A promising technique to solve this problem is under investigation. GRA

N91-27451# Rensselaer Polytechnic Inst., Troy, NY. Dept. of Chemistry.
A PROGRAM IN THE CHEMISTRY OF ELECTRONIC MATERIALS Final Report, Jul. 1985 - Dec. 1990
Robert R. Reeves 28 Feb. 1991 4 p
(Contract N00014-85-K-0632)
(AD-A235563) Avail: NTIS HC/MF A01 CSCL 09/1

Metal atom concentrations have been measured by atomic absorption to study plasma dry etching processes. The etch rate and the gas phase concentration of titanium metal atoms were observed as a function of total pressure during etching. A kinetic model and mechanisms was developed which fit these data and suggested a second order dependence on fluorine atoms. Using atomic emission actinometry this dependence was confirmed, supporting the proposed model. The gas phase reaction rate of Ti with SF5 was estimated to be fast, in the order of 10 percent of the collision rate. The results recently appeared in the literature. An analogous study was made on aluminum etching. While TiF was the etching product for titanium, AlCl3 appears to leave the metal surface when plasma etched with chlorine containing compounds. The work is being prepared for publication. The measurements of atoms was also applied to the production of metal films including both copper and tungsten. In both cases, metal atoms are made in the gas phase by reaction of H-atoms with metal precursors. Although the work requires further study for complete characterization of the deposited metal, the resultant films appear to be fine grained, adherent, and have good electrical properties. Reports of the work have been accepted for publication. GRA

N91-27452# Case Western Reserve Univ., Cleveland, OH.
IN-SITU SPECTROSCOPIC STUDIES OF REDOX ACTIVE SELF-ASSEMBLED MONOLAYERS ON GOLD ELECTRODE SURFACES Technical Report No. 70, 1989 - 1990
I. Bae, H. Huang, E. Yeager, and D. A. Scherson 30 Oct. 1990 23 p
(Contract N00014-90-J-1212)
(AD-A235564) Avail: NTIS HC/MF A03 CSCL 09/1

Monolayers of N-ethyl-N-octadecyl-4,4-bipyridinium (EOB) have been prepared on smooth gold surfaces prepared by spontaneous self-assembly of the electrochemically reduced form of the amphiphile and have been examined with in situ Fourier Transform Infrared Reflection Absorption Spectroscopy (FTIRRAS). Prominent positive-going peaks with hardly any detectable negative-going counterparts were observed in the normalized potential difference spectra of the layer in the reduced state (using as a reference the spectra for the layer in the fully oxidized state) in the region between 1100 and 1700 cm-1. In analogy with a model put forward by other workers it is proposed that the spectral bands originate from vibronically activated totally symmetric modes of EOB+ in monomeric and/or dimeric form. GRA

N91-27453# Northwestern Univ., Evanston, IL. Dept. of Chemistry.
EXPERIMENTAL ASSESSMENT OF DYNAMIC STRUCTURAL PARAMETERS FOR HOMOGENEOUS AND INTERFACIAL CHARGE-TRANSFER REACTIONS: CASE STUDIES BASED ON TIME-DEPENDENT RAMAN SCATTERING METHODS Final Technical Report
Steven K. Doorn, Robert L. Blackbourn, Christopher S. Johnson, and Joseph T. Hupp 19 Apr. 1991 45 p
(Contract N00014-88-K-0369)
(AD-A235570; TR-9) Avail: NTIS HC/MF A03 CSCL 09/1

The application of time-dependent scattering methodologies to dynamic structural problems involving charge transfer reactions is described. We show experimentally that a time-dependent analysis of resonance enhanced Raman scattering can lead to a complete mode-by-mode description of the vibrational structural changes accompanying charge transfer and, therefore, a complete description of the vibrational activation barrier to charge transfer. In other words, all force constants, mode displacements, bond length displacements, and individual energy components of the barrier can be determined. The strategy is illustrated with case studies of internal (metal-to-ligand) charge transfer, ligand-bridged metal-to-metal charge transfer, outer-sphere charge transfer, and interfacial charge-transfer. GRA

N91-27454# Mission Research Corp., Nashua, NH.
DOSIMETRY FOR MICROELECTRONICS Technical Report, 23 Sep. 1986 - 23 Feb. 1990
Edward A. Burke 1 May 1991 96 p
(Contract DNA001-86-C-0061)
(AD-A235601; MRC/NSH-R-89-009; DNA-TR-89-273) Avail: NTIS HC/MF A05 CSCL 09/1

Existing information on the dose enhancement effect is reviewed and current problems identified. Possible solutions are outlined. In addition, the design and use of a dual cavity ionization chamber for routine measurement of dose enhancement factors in cobalt-60 gamma test facilities is described. The enhancement factors can be derived directly from the chamber measurements without recourse to reference data that may be difficult to obtain. This relatively simple device reliably reproduced earlier results obtained by more involved equipment and procedures. Measured enhancement factors are reported for new material combinations not previously examined and compared with recent calculations. GRA

N91-27455# Wyoming Univ., Laramie. Dept. of Chemistry.
EQCM STUDIES OF FILM GROWTH, REDOX CYCLING, AND CHARGE TRAPPING OF n-DOPED AND p-DOPED POLY(THIOPHENE) Technical Report No. 13, Sep. 1990 - Jun. 1991
Ricardo Borjas and Daniel A. Buttry 29 Apr. 1991 33 p
(Contract N00014-90-J-1167)
(AD-A235603) Avail: NTIS HC/MF A03 CSCL 09/1

The electrochemical quartz crystal microbalance (EQCM) is used to monitor mass changes which accompany the growth, redox cycling, and charge trapping of thin films of poly(thiophene) (PT) at Au electrodes under potentiodynamic conditions. Mechanical conductance spectra of the EQCM/PT composite resonators reveal that the PT films behave as rigid layers, allowing use of the Sauerbrey equation for calculation of quantitative mass changes from the frequency changes recorded with the EQCM. Film growth by oxidation of 2,2'-bithiophene appears to proceed by production of soluble, short chain oligomers following oxidation, with precipitation a consequence of both reduction and increasing chain length. GRA

N91-27456# Naval Research Lab., Washington, DC.
SURFACE ACOUSTIC WAVE VAPOR SENSORS BASED ON RESONATOR DEVICES Memorandum Report

Jay W. Grate and Mark Klusty 23 May 1991 43 p
(AD-A235797; NRL-MR-6829) Avail: NTIS HC/MF A03 CSCL 09/4

Surface acoustic wave (SAW) devices fabricated in the resonator configuration have been used as organic vapor sensors and compared with delay line devices more commonly used. The experimentally determined mass sensitivities of 200, 300, and 400 MHz resonators and 158 MHz delay lines coated with Langmuir-Blodgett films of poly(vinyl tetradecanal) are in excellent agreement with theoretical predictions. The response of LB- and spray-coated sensors to various organic vapors were determined, and scaling laws for mass sensitivities, vapor sensitivities, and detection limits are discussed. The 200 MHz resonators provide the lowest noise levels and detection limits of all the devices examined. GRA

N91-27457# Utah Univ., Salt Lake City. Dept. of Chemistry.
GEOMETRICAL LINEAR RESPONSES AND DIRECTIONAL ENERGY DERIVATIVES FOR ENERGETICALLY DEGENERATE MCSCF ELECTRONIC FUNCTIONS Technical Report, Dec. 1990 - Mar. 1991
Keld L. Bak and Jack Simons 17 Apr. 1991 33 p
(Contract N00014-89-J-1497)
(AD-A236074; TR-17) Avail: NTIS HC/MF A03 CSCL 07/4

For state-averaged multiconfigurational self consistent field (SA-MCSCF) wave functions second order geometrical response equations are derived that allow the determination of first-order configuration amplitude responses for equally weighted, energetically degenerate states. The first-order response equations obtained in earlier work do not suffice to determine these particular response parameters. To formulate such a derivation in a well defined manner, it is found that a specific linear combination of the degenerate states must be formed; this specific combination of states then defines how state energies and wave functions evolve as one passes through the surface intersection. The linear combination among the degenerate states is dependent upon the molecular distortion for which the responses are to be evaluated. Expressions for first- and second-order directional energy derivatives for these energetically degenerate wave functions are also derived. All the equations obtained are computationally tractable and expressed in terms of quantities that result from optimizing the SA-MCSCF wavefunctions and from solving the first- and part of the second-order geometrical response equations. GRA

N91-27458# Pennsylvania State Univ., University Park. Materials Research Lab.
PIEZOELECTRIC AND ELECTROSTRICTIVE MATERIALS FOR TRANSDUCER APPLICATIONS, VOLUME 1 Annual Report, 1 Feb. 1990 - 31 Jan. 1991
L. E. Cross, R. E. Newnham, A. S. Bhalla, J. P. Dougherty, and J. H. Adair 31 Jan. 1991 288 p
(Contract N00014-89-J-1689)
(AD-A236219) Avail: NTIS HC/MF A13 CSCL 09/1

Highlights of the year's activity include: Participation of a number of senior faculty in program to better define the role of ferroelectrics in 'smart materials' and the manner in which these developing interests will impact the needs for transducers as both actuators and sensors. New progress has been made with the flextensional (moonie) type structures and with the evolution of the 1:3 composites towards commercial development as large area actuators. The year has seen major advance in the understanding of the relaxor type ferroelectrics which are most useful as dielectrics and electrostrictors. It has become clear that the original superparaelectric model is only a first approximation valid for the very high temperature behavior and that in fact both the Lead magnesium niobate and the PZT materials are close analogues of the magnetic spin glasses. Interaction between the polar micro-regions leads to a Vogel-Fulcher like slowing down and freezing, and provides understanding of the micros to macrodomain transitions, the hysteretic behavior and the coupled elastic responses. An essential component of the program is the excellent capability in synthesis and processing which has been developed to provide the many new compositions and controlled microstructures which are essential for the proper understanding of the properties. GRA

N91-27459# Pennsylvania State Univ., University Park. Materials Research Lab.
PIEZOELECTRIC AND ELECTROSTRICTIVE MATERIALS FOR TRANSDUCER APPLICATIONS, VOLUME 2 Annual Report, 1 Feb. 1990 - 31 Jan. 1991
L. E. Cross, R. E. Newnham, A. S. Bhalla, J. P. Dougherty, and J. H. Adair 31 Jan. 1991 341 p
(Contract N00014-89-J-1689)
(AD-A236220) Avail: NTIS HC/MF A15 CSCL 20/3

This report documents work carried out on piezoelectric and electrostrictive materials for transducer applications. It discusses the role of ferroelectrics in smart materials and the manner in which these developing interests will impact the needs for transducers as both actuators and sensors. New progress has been made with the flextensional (moonie) type structures and with the evolution of the 1:3 composites towards commercial development as large area actuators. Major advances have been made in the understanding of the relaxor type ferroelectrics which are most useful as dielectrics and electrostrictors. It has become clear that the original superparaelectric model is only a first approximation valid for the very high temperature behaviour and that in fact both the Lead magnesium niobate and the PZT materials are close analogues of the magnetic spin glasses. Interaction between the polar micro-regions leads to a Vogel-Fulcher like slowing down and freezing, and provides understanding of the micros to macrodomain transition, the hysteretic behavior and the coupled elastic responses. Excellent capability in synthesis and processing has been developed to provide many new compositions and controlled microstructure which are essential for the proper understanding of the properties. GRA

N91-27460# Wright Research Development Center, Wright-Patterson AFB, OH.
PERCEPTUAL LIMITATIONS OF PERIPHERALLY DISPLAYED COLORS ON CRTS Final Report, Jan. 1990 - Jan. 1991
Eileen G. Ancman Mar. 1991 44 p
(AD-A236289; WL-TM-91-309-FIGK) Avail: NTIS HC/MF A03 CSCL 09/5

Cathode ray tubes are currently used in aircraft cockpits to relay important color coded information necessary for mission completion and pilot survival. Color CRT's presently used are as large as 6 x 6 inch, but are projected to increase in size until the all glass cockpit is achieved. As the display gets larger, peripheral vision may be relied upon even more heavily. Peripheral vision is also important in present situations involving more than one CRT display used in a row, and especially when the pilot is in a head-up mode. The research in this report dealt with a subject's ability to recognize in their peripheral vision the three primary colors, blue, green, and red, on a cathode ray tube (CRT) with all three guns adjusted to achieve equal luminance. Data for various subject psychological states (normal, stressed, and relaxed) was collected. Percent error (e.g., how many times red was perceived as green or blue) was recorded for each state and color. A second performance measure, visual field dimension (e.g., degrees off of fovea where the color of the circle was correctly perceived) along the x-axis, was also collected for each color and psychological state. GRA

N91-27461# California Univ., San Francisco.
SYNTHESIS OF A SELF-ASSEMBLING SUPRAMOLECULAR LATTICE Annual Progress Report, 1 May - 1 Jun. 1991
C. A. Hunt and Roderick D. MacGregor 1 Jun. 1991 3 p
(Contract N00014-91-J-1455)
(AD-A236358) Avail: NTIS HC/MF A01 CSCL 09/1

The goal of this project is to construct a self-assembling, closed, hollow, uniform, supramolecular lattice in which the lattice dimensions measure between 10 and 100 nm, and which exhibits two hierarchical levels of molecular order. Our approach is novel. Use the membrane skeleton of erythrocytes, which is an ordered,

two dimensional molecular lattice, as a template to construct a synthetic lattice that remains intact, functional and responsive after removal of the template. GRA

N91-27462# Harry Diamond Labs., Adelphi, MD.
INVESTIGATION OF CONFORMAL COATINGS FOR ELECTRONIC CIRCUITS Final Report, Mar. 1989 - Aug. 1990
L. G. Ferguson Apr. 1991 48 p
(AD-A236402; HDL-SR-91-3) Avail: NTIS HC/MF A03 CSCL 09/1

Dielectric coating of semiconductor device packages is important not only for insulation and humidity protection but also to protect the metal leads of a package from being exposed to nuclear weapon x-rays. If exposed, these leads emit electrons, creating unwanted currents which could disrupt electronic circuits or damage sensitive electronic devices. As electronic devices have become more complex, so have their packages. A consequence of this complexity is the difficulty of thoroughly coating all the leads (pins) of the device with at least 3 mils of dielectric and assuring that there are no voids around any of the pins. Seven products were evaluated for their ability to uniformly coat (void-free) the pins of a 244-pin grid array. Four products, Conap EN-11, Dow Corning 93-500, McGhan Nusil CU-2500, and Solithane 113, were found to be acceptable. Of the four, Solithane 113 and Conap EN-11 are the most cost effective. The report provides the experimental procedure, pricing information, and technical data sheets which list specific information on those products that were found to be acceptable. GRA

N91-27463# Boeing Aerospace and Electronics Co., Seattle, WA.
GENERIC LINEAR MICROCIRCUIT TEST REQUIREMENTS Final Report, Aug. 1989 - Aug. 1990
Steve K. Tanemura and Ronald R. Mitchell Apr. 1991 207 p
(Contract F30602-89-C-0169)
(AD-A236421; RL-TR-91-38) Avail: NTIS HC/MF A10 CSCL 09/1

The Generic Linear Microcircuit Test Requirements Program is outlined. The objective was to develop new series-4000 test specifications to standardize testing of linear devices. The drafts developed will replace the existing series-4000 methods in MIL-STD-883C. New series-4000 drafts for 11 device families were developed, which will cover the majority of the linear microcircuits used in military systems. The test methods specified in each draft referenced a variety of sources including M38510 slash sheets, industry standard procedures, literature, existing test methods in MIL-STD-883C, and newly developed methods. Completion of these drafts will provide more consistent testing of linear devices. All aspects of the program are reviewed. GRA

N91-27464# University of Southern California, Marina del Rey. Information Sciences Inst.
NETLIST(+): A SIMPLE INTERFACE LANGUAGE FOR CHIP DESIGN
Tzyh-Yung Wuu Apr. 1991 79 p
(Contract F29601-87-C-0069)
(AD-A236444; ISI/RR-91-282) Avail: NTIS HC/MF A05 CSCL 12/5

NetList (+) is a design specification language developed at MOSIS for rapid turn-around cell-based ASIC prototyping. By using NetList (+), a uniform representation is achieved for the specification, simulation, and physical description of a design. The goal is to establish an interfacing methodology between design specification and independent computer aided design tools. Designers need only to specify a system by writing a corresponding netlist. This netlist is used for both functional simulation and timing simulation. The same netlist is also used to derive the low level physical tools to generate layout. Another goal of using NetList (+) is to generate parts of a design by running it through different kinds of placement and routing (P and R) tools. For example some parts of a design will be generated by standard cell P and R tools. Other parts may be generated by a layout tiler; i.e., datapath compiler, RAM/ROM generator, or PLA generator. Finally all different parts of a design can be integrated by general block P and R tools as a single chip. The NetList (+) language can actually act as an interface among tools. Section 2 shows a flowchart to illustrate the NetList (+) system and its relation with other related design tools. Section 3 shows how to write a NetList (+) description from the block diagram of a circuit. In section 4 discusses how to prepare a cell library or several cell libraries for a design system. Section 5 gives a few designs by NetList (+) and shows their simulation and layout results. GRA

N91-27465# Wisconsin Univ., Madison. Dept. of Chemistry.
STRUCTURAL AND ELECTRICAL PROPERTIES OF TITANIUM-NICKEL FILMS DEPOSITED ONTO SILICON SUBSTRATES
Kathleen R. Collen, Arthur B. Ellis, J. D. Busch, and A. D. Johnson 20 May 1991 9 p
(Contract N00014-85-K-0631)
(AD-A236445; UWIS/DC/TR-91/3) Avail: NTIS HC/MF A02 CSCL 09/1

Thin films of the shape memory alloy NiTi were sputter-deposited onto p-type silicon substrates. Films that are initially amorphous may be crystallized by vacuum annealing. The crystalline films exhibit the B2 to greater than B19' phase change associated with the shape memory effect while remaining in contact with the silicon substrate. Transition temperatures were determined by resistance measurements and x ray diffraction. The NiTi-Si contacts are diodes, as evidenced by their current-voltage characteristics; however, the effect of the phase change on the barrier height could not be determined. GRA

N91-27466# Cornell Univ., Ithaca, NY.
UNDERPOTENTIAL DEPOSITION OF SILVER ON Pt(111). PART 1: CONCENTRATION DEPENDENCE
J. F. Rodriguez, D. L. Taylor, and H. D. Abruna 1990 42 p
Sponsored by ONR and ARO
(AD-A236692) Avail: NTIS HC/MF A03 CSCL 09/1

We report on the concentration dependence of the underpotential deposition of silver on well-defined Pt(111) electrodes. Electrochemical as well as ultra high vacuum surface techniques have been employed. We have found that when the silver ion concentration is 1.00 mM the electrodeposition is via adsorption in a well-defined manner, whereas at a concentration of 0.005 mM the mechanism involves three dimensional nucleation and island formation. In addition, two monolayers of silver are deposited at underpotentials but the stability of the second layer is a strong function of the silver ion concentration in solution. When the silver ion concentration is 1.00 mM, rinsing the electrode (with supporting electrolyte containing no silver in solution) at controlled potential results in essentially complete removal of the second layer of silver. GRA

N91-27467# Texas Instruments, Inc., Dallas.
CIM 10-MICROMETERS ARRAY DEVELOPMENT Final Technical Report, 20 Aug. 1986 - 31 Dec. 1989
E. J. Esposito, J. P. Omaggio, R. W. Gooch, L. A. Wood, and R. B. Garner 31 Jan. 1991 142 p
(Contract N00014-86-C-2379)
(AD-A236781; TI-91-08) Avail: NTIS HC/MF A07 CSCL 17/5

A 480 x 4 element charge imaging matrix (CIM) scanning focal plane has been developed for IR search/track applications in the 8 to 12 micron band. The CIM array consists of 8 rows of 240 elements on 3-mil centers (cross-scan), with an active pixel area of 1.6 x 1.7 mil-sq, and four stages of time-delay-and-integration (TDI). Arrays are fabricated in thinned LWIR HgCdTe and vertically interconnected to underlying custom-designed Si IC processors. A linear (480 x 1) version of the design was also implemented, along with wire-bondable (nonvertically integrated) versions of both arrays for performance analysis and diagnostics. A parallel technology study addressed LWIR CIM performance issues, including detector noise mechanisms, diode leakage current and noise reduction, 1/f noise sources, and the effects of substrate thinning on p-type HgCdTe MIS properties. GRA

N91-27468# Rutgers - The State Univ., Piscataway, NJ. Dept. of Mechanics and Materials Science.
HIGH TEMPERATURE CHARACTERISTICS OF NYLON-11 AND NYLON-7 PIEZOELECTRICS
Y. Takase, J. W. Lee, J. I. Scheinbeim, and B. A. Newman May 1991 50 p
(Contract N00014-88-K-0122)
(AD-A236809; TR-23) Avail: NTIS HC/MF A03 CSCL 09/1

The piezoelectric strain constant, d31, stress constant, e31, and the electromechanical coupling coefficients, k31, of Nylon-11 and Nylon-7 films were measured up to a temperature close to their melting points. They were found to exhibit their highest values and, in addition, excellent thermal stability at temperatures between 100 and 200 C. Maximum stable values were d312 = 14pC/n and e31 = 21 mC/m2 for Nylon-11, and d31 = 17 pC/N and e31 = 27 mC/m2 for Nylon-7. Corresponding values of k31 were 0.49 and 0.54. Poled and then annealed Nylon samples exhibit little decay of these values even after annealing at 185 and 200 C for Nylon-11 and Nylon-7, respectively while poly(vinylidene fluoride) samples showed a large decay in response, decreasing to 4.9 pC/N, 11 mC/m, and k = 0.019 after annealing at 175 C. The extraordinary stability of the piezoelectric activity of these Nylon samples was considered to be related to ferroelectric reorientation of the amide groups dipoles followed by closer packing of the hydrogen bonded sheet structure in the crystalline regions after the annealing treatment. GRA

N91-27469# Naval Postgraduate School, Monterey, CA.
Ku-BAND HIGH POWER AMPLIFIER SYSTEM FUNCTIONALITY AND OPERATION M.S. Thesis
Cheng C. Feng Jun. 1990 123 p
(AD-A236912) Avail: NTIS HC/MF A06 CSCL 09/1

The subsystems and their respective functionality of a ku-band high power amplifier are carefully documented. Figures identifying physical components, wiring, contact points, switches, and valves with their labels on the system blueprints are presented. These figures will be helpful if system performance parameter adjustments are desired. Operation, maintenance, troubleshooting, and testing procedures are also included to make this thesis a self-contained operator's manual for the high power amplifier. GRA

N91-27470# University of Northern Illinois, De Kalb. Dept. of Chemistry.
INVESTIGATION OF THE INTERFACE BETWEEN TWO IMMISCIBLE ELECTROLYTES APPLIED TO MEMBRANE ELECTROCHEMISTRY Final Report, 16 Oct. 1988 - 15 Apr. 1991
Petr Vanysek 15 May 1991 10 p
(Contract N00014-88-K-0075; NR Proj. RR0-4108)
(AD-A236916) Avail: NTIS HC/MF A02 CSCL 09/1

The final report sums the work done on immiscible electrolyte solutions and their interfaces during the duration of the contract. Two categories of findings are presented; instrumentation development and modification, and inquiry into new physical principles. New instrumentation includes: Automated apparatus for impedance measurement, apparatus for work on microinterfaces, apparatus for light beam deflection studies, apparatus for impedance determination from analysis of noise signal. New findings include: study on potential sensitive fluorescent dyes, study of adsorption of proteins on water/nintrobenzene interfaces, development of microinterface as a model of channel transport and as an analytical probe, studies of ion transport in ion exchange membrane structure. GRA

N91-27471# Northwestern Univ., Evanston, IL. Dept. of Electrical Engineering and Computer Science.
ESTIMATION AND CONTROL OF NONLINEAR AND HYBRID SYSTEMS Final Report, 15 Jan. 1989 - 14 Oct. 1990
A. H. Haddad 14 Oct. 1990 82 p
(Grant AF-AFOSR-0241-89; AF Proj. 2304)
(AD-A236938; AFOSR-91-0527TR) Avail: NTIS HC/MF A05 CSCL 09/1

The research covers several aspects of the basic issues that are needed to develop and implement nonlinear filtering and control of maneuvering vehicles in uncertain environments and nonlinear geometry. The research is involved in modelling maneuvering nonlinear vehicles such as switched linear Markov models. The research therefore leads in several directions investigating various aspects of such models which in general are called hybrid systems. Three different aspects are considered: The first involves realization and other generic properties of hybrid systems, including controllability and stability as well as simulation and averaging. The second involves estimation and detection systems for hybrid systems, including various related models and approximate filtering schemes. The third involves the application of switched Markov filtering schemes to the tracking of maneuvering vehicles. GRA

N91-27472# Naval Air Development Center, Warminster, PA. Air Vehicle and Crew Systems Technology Dept.
THE 270 VOLT DIRECT CURRENT GENERATOR PERFORMANCE EVALUATION Final Report, Jun. - Aug. 1990
Jenifer M. Shannon Dec. 1990 45 p
(NR Proj. W13-55)
(AD-A236946; NADC-91003-60) Avail: NTIS HC/MF A03 CSCL 10/2

This document presents the results of the testing of a 45 kW, 270 VDC generator. Parameters measured include line voltage, field current, peak-to-peak ripple voltage, distortion spectrum, and transients due to both load application and load removal. The purpose of this testing was to provide a baseline of 270 VDC generator performance. The baseline data will be used as an input of the revision of MIL-STD-704D, the aircraft power quality specification. The performance of the generator under test exceeded expectations. The conclusion of this testing is that no significant problems should be encountered by generator vendors in their efforts to meet the new 270 VDC requirements set forth in MIL-STD-704E. GRA

N91-27473# Science Applications International Corp., McLean, VA.
EXPERIMENTAL AND THEORETICAL INVESTIGATION OF INNOVATIVE BROADBAND MICROWAVE DEVICES Final Report
May 1991 164 p
(Contract N00014-88-C-2173)
(AD-A236960; SAIC-91-1135) Avail: NTIS HC/MF A08 CSCL 09/1

The general scope of the work performed under this contract was quite broad and included both theoretical and experimental work related to the general problem of microwave and millimeter wave sources. The principal concepts which were of interest at the outset of the contract were the Two-Stream-Amplifier and the Cerenkov Maser. However, general theory and simulation of the Ubitron/Free-Electron Laser was also performed along with specific theoretical support for the Ubitron development program in the Vacuum Electronics Branch. In addition, a great deal of interest developed in the application of Field-Emission Arrays to RF source technology, and the experimental phase of the program shifted to encompass testing, design, and evaluation of several different approaches of this technology. The remainder of this report is devoted to a specific discussion of each phase of the program. GRA

N91-27474# Wisconsin Univ., Madison. Dept. of Chemistry.
ATOMIC-SCALE CHARGE TRANSPORT AT THE Si(001) SURFACE Technical Report No. 6
David G. Cahill and R. J. Hamers 30 May 1991 16 p
(Contract N00014-91-J-1629)
(AD-A236970) Avail: NTIS HC/MF A03 CSCL 09/1

Scanning tunneling microscopy measurements of local surface photovoltage of the Si(001) surface reveal the existence of local charging produced by the tunneling current. Atomic-scale variations in the charge transport arise at characteristic defects, step edges and structures produced by epitaxial growth. The decay time of the surface charge is on the order of 10-10 sec. A Coulomb

blockade energy of 0.35 eV is estimated from tunneling spectroscopy measurements of the bonding configuration of the type-B step. GRA

N91-27475# Rutgers - The State Univ., Piscataway, NJ. Dept. of Mechanics and Materials Science.
FERROELECTRIC POLARIZATION SWITCHING IN NYLON 11
J. W. Lee, Y. Takase, B. A. Newman, and J. I. Scheinbeim May 1991 16 p
(Contract N00014-88-K-0122)
(AD-A236985; TR-19) Avail: NTIS HC/MF A03 CSCL 09/1

Cold drawn nylon 11 films, which were prepared by stretching the melt quenched films to a draw ratio of 2.8:1 at room temperature, were found to exhibit an electric displacement vs. electric field hysteresis loop. The results confirmed that the nylon 11 film exhibited ferroelectric behavior at room temperature or lower. The coercive fields were 65, 98, 125, 160 and 215 MV/m at 20, 0, -20, -40 and -60 C and the remanent polarization at -20 C (where there was considerably less dc conduction) was 56 mC/sq m. Switching of the polarization was almost completed within 20 ms. GRA

N91-27476*# Raytheon Co., Lexington, MA.
THE 60 GHz SOLID STATE POWER AMPLIFIER Final Report
J. McClymonds 1 Mar. 1991 62 p
(Contract NAS5-30356)
(NASA-CR-188669; NAS 1.26:188669) Avail: NTIS HC/MF A04 CSCL 09A

A new amplifier architecture was developed during this contract that is superior to any other solid state approach. The amplifier produced 6 watts with 4 percent efficiency over a 2 GHz band at 61.5 GHz. The unit was 7 x 9 x 3 inches in size, 5.5 pounds in weight, and the conduction cooling through the baseplate is suitable for use in space. The amplifier used high efficiency GaAs IMPATT diodes which were mounted in 1-diode circuits, called modules. Eighteen modules were used in the design, and power combining was accomplished with a proprietary passive component called a combiner plate. Author

N91-27477*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, OH.
COPLANAR WAVEGUIDE FEEDS FOR PHASED ARRAY ANTENNAS
Rainee N. Simons (Sverdrup Technology, Inc., Brook Park, OH.) and Richard Q. Lee 1991 9 p Presented at the Conference on Advanced Space Exploration Initiative Technologies, Cleveland, OH, 4-6 Sep. 1991; sponsored by AIAA, NASA, and OAI
(NASA-TM-104467; E-6315; NAS 1.15:104467; AIAA-91-3422)
Avail: NTIS HC/MF A02 CSCL 09C

The design and performance is presented of the following Coplanar Waveguides (CPW) microwave distribution networks for linear as well as circularly polarized microstrip patches and dipole arrays: (1) CPW/Microstrip Line feed; (2) CPW/Balanced Stripline feed; (3) CPW/Slotline feed; (4) Grounded CPW/Balanced coplanar stripline feed; and (5) CPW/Slot coupled feed. Typical measured radiation patterns are presented, and their relative advantages and disadvantages are compared. Author

N91-27478* National Aeronautics and Space Administration. Pasadena Office, CA.
METAL CHLORIDE CATHODE FOR A BATTERY Patent
Ratnakumar V. Bugga, inventor (to NASA), Salvador DiStefano, inventor (to NASA), and C. Perry Bankston, inventor (to NASA) (Jet Propulsion Lab., California Inst. of Tech., Pasadena.) 28 May 1991 10 p Filed 30 Mar. 1990
(Contract NAS7-918)
(NASA-Case-NPO-17809-1-CU; US-Patent-5,019,470;
US-Patent-Appl-SN-503409; US-Patent-Class-429-223;
US-Patent-Class-29-623.5; Int-Patent-Class-H01M-4/58;
Int-Patent-Class-H01M-4/04) Avail: US Patent and Trademark Office CSCL 10C

A method of fabricating a rechargeable battery is disclosed which includes a positive electrode which contains a chloride of a selected metal when the electrode is in its active state. The improvement comprises fabricating the positive electrode by: providing a porous matrix composed of a metal; providing a solution of the chloride of the selected metal; and impregnating the matrix with the chloride from the solution.
Official Gazette of the U.S. Patent and Trademark Office

N91-27479* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, MD.
DIFFERENTIAL CURRENT SOURCE Patent
John F. Sutton, inventor (to NASA) 4 Jun. 1991 7 p Filed 6 Oct. 1989
(NASA-Case-GSC-13280-1; US-Patent-5,021,729;
US-Patent-Appl-SN-418373; US-Patent-Class-323-311;
US-Patent-Class-323-312; Int-Patent-Class-G05F-1/12) Avail: US Patent and Trademark Office CSCL 09C

A differential, voltage-controlled current source, employing operational amplifiers as the active elements, provides an essentially symmetrical, differential, high impedance drive to a load, the drive being isolated from any circuit common or system ground. Because of the floating differential drive and the identical source impedances of the two outputs, errors from common mode voltage are eliminated.
Official Gazette of the U.S. Patent and Trademark Office

N91-27480# Lisbon Univ. (Portugal). Inst. Superior Tecnico.
DC-AC CONVERTER WITH HIGH FREQUENCY RESONANT LINK Ph.D. Thesis
Maria Beatriz Mendes Borges 1990 340 p In PORTUGUESE; ENGLISH summary
(PB91-177758) Avail: NTIS HC/MF A15 CSCL 09A

A DC-AC resonant topology is proposed intended to high power levels. Using an input current fed resonant inverter to generate high frequency resonant voltage, and a single phase output cycloconverter to modulate and control the voltage, one obtains low frequency sinusoidal voltage and current at the load terminals. The resonant inverter with several different load conditions is studied, and it is shown how it is possible to obtain a DC-AC converter that operates with thyristors, without the need of any forced commutation circuitry. A firing process is given that permits the stabilization of the resonant voltage. The high frequency fed cycloconverter modulation processes are studied, and the output amplitude voltage spectrum of a programmed waveform pulse width modulation commutated inverter. Considering the intrinsic operating characteristics of the converter, it is proposed a current mode control process that uses the cycloconverter output current prediction. The control process allows good output voltage regulation, with low distortion and low harmonic content. This can be confirmed from the experimental results obtained. GRA

N91-27972# Tohoku Univ., Sendai (Japan). Inst. for Materials Research.
DEVELOPMENT OF WIRE AND COIL DESIGNING FOR HIGH-MAGNETIC FIELD GENERATION
Giyuu Kido *In* National Inst. for Fusion Science, Proceedings of a Workshop on Emissions from Heavy Current Carrying High Density Plasma and Diagnostics May 1991 p 92-101 (For primary document see N91-27962 19-75)
Avail: NTIS HC/MF A06

34 FLUID MECHANICS AND HEAT TRANSFER

Includes boundary layers; hydrodynamics; fluidics; mass transfer; and ablation cooling.

For related information see also *02 Aerodynamics* and *77 Thermodynamics and Statistical Physics.*

N91-27481# Universitaet der Bundeswehr Muenchen, Neubiberg (Germany, F.R.). Inst. fuer Raumfahrttechnik.
RESPONSE OF AN ANNULAR CYLINDRICAL LIQUID COLUMN TO VARIOUS AXIAL EXCITATIONS IN ZERO-GRAVITY
Helmut F. Bauer 1990 38 p Previously announced in IAA as A91-20149
(LRT-WE-9-FB-7(1990); ETN-91-99247) Avail: NTIS HC/MF A03

An annular liquid layer in a zero gravity environment is subjected to different harmonic axial excitations. The liquid is treated as frictionless and is held together by free surface tension, which acts as the restoring force. The response of the system is determined for the free surface elevation and the velocity distribution. The first resonance response is found to be sharply tuned and could easily be missed in a sweeping experiment. Damping is introduced in the resonance terms. ESA

N91-27482# Tokyo Univ., Sagamihara (Japan). Inst. of Space and Astronautical Science.
NUMERICAL STUDY ON CUT-AND-CONNECT OF THREE-DIMENSIONAL VORTEX TUBES
H. L. Chen Feb. 1991 64 p
(ISAS-639; ISSN-0285-6808) Avail: NTIS HC/MF A04

The generation of two vortex rings and their cut-and-connect process were numerically simulated by solving three-dimensional and time-dependent Navier-Stokes equations, under conditions similar to the laboratory experiment. In order to explain the mechanism of cut-and-connect, velocity, vorticity, pressure, helicity density, and energy dissipation were examined for the flow field of the cut-and-connect of vortex rings. The present study revealed that energy dissipation is an essential process for circulation cancellation during vortex tubes cutting. Based on this energy dissipation mechanism, it is concluded that the cut-and-connect of vortex tubes may occur in the limit of inviscid flows. This conclusion is particularly important to the three dimensional discrete vortex method for computing high Reynolds number flows. Features of helicity in the three dimensional flow field of the cut-and connect of vortex tubes were also investigated. The relation between the helicity density and the energy dissipation function in the three dimensional flow field was examined. Author

N91-27483# Surface Combustion, Inc., Maumee, OH.
TESTING OF CERAMIC RADIANT TUBE HEATING SYSTEM Topical Report, Mar. - Sep. 1990
T. J. Kuhn, J. M. OBrien, and T. J. Schultz Nov. 1990 144 p
(Contract GRI-5088-235-1726)
(PB91-161323; Rept-1357; GRI-90/0319) Avail: NTIS HC/MF A07 CSCL 20D

Questions concerning the feasibility and performance of a gas fired ceramic radiant tube heating system to heat a 2350 F vacuum chamber were answered in a test program. Permeability tests run up to 2250 F on reaction bonded SiC showed the material to be substantially impermeable to gas exchange within the furnace environment. An upper limit of flue gas leakage was placed at 3.8 x 10(exp -8) SCFH/sq in of tube surface. The thermal efficiency of the tube/burner systems was found to range from 75 to 65 pct. as the furnace temperature ranged from 1500 to 2350 F. SiC radiant tubes were exposed to thermal gradients and mechanical loading at least as severe as those expected in industrial applications. No indication of tube failure resulting from these conditions were indicated. Tube failures were seen at the closed end of some tubes as a result of overheating. Solutions involving burner design and operation were identified. A developed concept of horizontal tube mounting and sealing was successfully tested. Author

N91-27484# Ballistic Research Labs., Aberdeen Proving Ground, MD.
NUMERICAL SIMULATION OF REACTING FLOW IN A THERMALLY CHOKED RAM ACCELERATOR-MODEL DEVELOPMENT AND VALIDATION Final Report, Mar. - Sep.
Michael J. Nusca Apr. 1991 59 p
(DA Proj. 1L1-62618-AH-80)
(AD-A234080; BRL-TR-3222) Avail: NTIS HC/MF A04 CSCL 19/10

Computational fluid dynamics solutions of the Navier-Stokes equations were applied to both non-reacting and reacting in-bore flow fields for a ram accelerator projectile launch system. In this system, a projectile is injected at supersonic velocity into a stationary tube filled with a pressurized mixture of hydrocarbon, oxidizer and inert gases. After ignition, the shock system generated by the projectile can result sustained combustion around and aft of the projectile. This energy release process which travels with the projectile also generates high pressures and imparts thrust to the projectile. Numerical simulations reveal in-bore flow field details provide a good comparison with measured launch tube wall pressures for both nonreacting and reacting flows and a 38 mm system. Computations are also used to investigate a proposed 120 mm ram accelerator system. GRA

N91-27485# Los Alamos National Lab., NM.
DEMONSTRATION OF LIQUID METAL/FABRIC HEAT PIPES
M. A. Merrigan, J. T. Sena, and M. D. Keddy 1991 20 p Presented at the ASME/AIChE/ANS National Heat Transfer Conference, Minneapolis, 26-31 Jul. 1991
(Contract W-7405-eng-36)
(DE91-008584; LA-UR-91-498; CONF-910739-10) Avail: NTIS HC/MF A03

The influence of protective fabric covering on heat rejection rates for high temperature spacecraft radiators was investigated. Aluminaborosilicate was the fabric used in experiments. Stainless steel heat pipes with sodium as the working fluids were used as radiators. The experiments showed that the radiation performance of the fabric covered surfaces was strongly affected by the emissivity of the underlying metal substrate. DOE

N91-27486*# National Aeronautics and Space Administration. Langley Research Center, Hampton, VA.
CALCULATION OF CONVECTIVE AND RADIATIVE HEATING ON THE FOREBODY HEATSHIELD OF THE AEROASSIST FLIGHT EXPERIMENT VEHICLE
H. Harris Hamilton, II and Robert B. Greendyke (Analytical Services and Materials, Inc., Hampton, VA.) May 1991 71 p
(NASA-TM-104103; NAS 1.15:104103) Avail: NTIS HC/MF A04 CSCL 20D

The total (convective and radiative) heating is calculated over the entire forebody heatshield of the Aeroassist Flight Experiment (AFE) vehicle. The convective heating is calculated using a three-dimensional Navier-Stokes code (LAURA) which includes both chemical and thermal nonequilibrium effects. The flowfield solution is then used to provide inputs to a nonequilibrium air radiation code (NEQAIR) to calculate the nonequilibrium radiative heating. Results are presented at two points on the current Baseline 5A trajectory corresponding to the start of the primary data taking period and peak heating. Author

N91-27487*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, OH.
TURBULENT FLUID MOTION 2: SCALARS, VECTORS, AND TENSORS
Robert G. Deissler Jul. 1991 14 p
(NASA-TM-103756; E-6012; NAS 1.15:103756) Avail: NTIS HC/MF A03 CSCL 20D

The author shows that the sum or difference of two vectors is a vector. Similarly the sum of any two tensors of the same order is a tensor of that order. No meaning is attached to the sum of

tensors of different orders, say u(sub i) + u(sub ij); that is not a tensor. In general, an equation containing tensors has meaning only if all the terms in the equation are tensors of the same order, and if the same unrepeated subscripts appear in all the terms. These facts will be used in obtaining appropriate equations for fluid turbulence. With the foregoing background, the derivation of appropriate continuum equations for turbulence should be straightforward. Author

N91-27488*# Minnesota Univ., Minneapolis. Dept. of Mechanical Engineering.
FREE-STREAM TURBULENCE AND CONCAVE CURVATURE EFFECTS ON HEATED, TRANSITIONAL BOUNDARY LAYERS, VOLUME 1 Final Report
J. Kim and T. W. Simon Aug. 1991 188 p Sponsored in part by AFOSR Original contains color illustrations
(Grant NAG3-881)
(NASA-CR-187150; NAS 1.26:187150) Avail: NTIS HC/MF A09; 1 functional color page CSCL 20D

An experimental investigation of the transition process on flat-plate and concave curved-wall boundary layers for various free-streem turbulence levels was performed. Where possible, sampling according to the intermittency function was made. Such sampling allowed segregation of the signal into two types of behavior: laminar-like and turbulent-like. The results from the investigation are discussed. Documentation is presented in two volumes. Volume one contains the text of the report including figures and supporting appendices. Volume two contains data reduction program listings and tabulated data. Author

N91-27489*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, OH.
VISUALIZATION TECHNIQUES TO EXPERIMENTALLY MODEL FLOW AND HEAT TRANSFER IN TURBINE AND AIRCRAFT FLOW PASSAGES
Louis M. Russell and Steven A. Hippensteele Washington Jun. 1991 19 p Original contains color illustrations
(NASA-TM-4272; E-5811; NAS 1.15:4272) Avail: NTIS HC/MF A03; 7 functional color pages CSCL 20D

Increased attention to fuel economy and increased thrust requirements have increased the demand for higher aircraft gas turbine engine efficiency through the use of higher turbine inlet temperatures. These higher temperatures increase the importance of understanding the heat transfer patterns which occur throughout the turbine passages. It is often necessary to use a special coating or some form of cooling to maintain metal temperatures at a level which the metal can withstand for long periods of time. Effective cooling schemes can result in significant fuel savings through higher allowable turbine inlet temperatures and can increase engine life. Before proceeding with the development of any new turbine it is economically desirable to create both mathematical and experimental models to study and predict flow characteristics and temperature distributions. Some of the methods are described used to physically model heat transfer patterns, cooling schemes, and other complex flow patterns associated with turbine and aircraft passages. Author

N91-27490*# Institute for Computer Applications in Science and Engineering, Hampton, VA.
OPTIMAL CONTROL OF LIFT/DRAG RATIOS ON A ROTATING CYLINDER Final Report
Yuh-Roung Ou and John A. Burns (Virginia Polytechnic Inst. and State Univ., Blacksburg.) Jun. 1991 14 p Submitted for publication
(Contract NAS1-18605; AF-AFOSR-0079-89; AF-AFOSR-0001-89)
(NASA-CR-187586; NAS 1.26:187586; ICASE-91-49) Avail: NTIS HC/MF A03 CSCL 20D

The numerical solution to a problem of maximizing the lift to drag ratio by rotating a circular cylinder in a two-dimensional viscous incompressible flow is presented. This problem is viewed as a test case for the newly developing theoretical and computational methods for control of fluid dynamic systems. The authors show that the time averaged lift to drag ratio for a fixed finite time interval achieves its maximum value at an optimal rotation rate that depends on the time interval. Author

N91-27491# Vrije Univ., Brussels (Belgium). Dept. of Fluid Mechanics.
RADIAL MIXING IN TURBOMACHINES Final Report, 1 Jul. 1989 - 31 Jul. 1990
P. Segaert, Ch. Hirsch, and J. DeRuyck 31 Mar. 1991 190 p
(Grant AF-AFOSR-0375-89; AF Proj. 2307)
(AD-A235507; VUB-STR-17; AFOSR-91-0469TR) Avail: NTIS HC/MF A09 CSCL 20/4

A method for computing the effects of radial mixing in a turbomachinery blade row has been developed. The method fits in the framework of a quasi-3D flow computation and hence is applied in a corrective fashion to through flow distributions. The method takes into account both secondary flows and turbulent diffusion as possible sources of mixing. Secondary flow velocities determine the magnitude of the convection terms in the energy redistribution equation while a turbulent diffusion coefficient determines the magnitude of the diffusion terms. Secondary flows are computed by solving a Poisson equation for a secondary streamfunction on a transversal S3-plane, whereby the right-hand side axial vorticity is composed of different contributions, each associated to a particular flow region: inviscid core flow, end-wall boundary layers, profile boundary layers and wakes. The turbulent mixing coefficient is estimated by a semi-empirical correlation. Secondary flow theory is applied to the VUB cascade testcase and comparisons are made between the computational results and the extensive experimental data available for this testcase. This comparison shows that the secondary flow computations yield reliable predictions of the secondary flow pattern, both qualitatively and quantitatively, taking into account the limitations of the model. However, the computations show that use of a uniform mixing coefficient has to be replaced by a more sophisticated approach. GRA

N91-27492# Aerospace Corp., El Segundo, CA. Vehicle and Control Systems Div.
THE STABILITY OF A PRECESSING VEHICLE WITH OUTFLOW Final Report
J. W. Murdock and R. X. Meyer 15 Apr. 1991 67 p
(Contract F04701-88-C-0089)
(AD-A235957; TR-0089(4464-06)-1; SD-TR-91-12) Avail: NTIS HC/MF A04 CSCL 20/4

The precessional stability of a spinning solid body with fluid expelled from a cylinder on the aft end is considered. At the closed end of the cylinder, an end-burning propellant grain generates an inviscid, incompressible axial flow which exits at the aft end of the cylinder. If the nutation angle is small, the equations governing the flow are linear. With an appropriate choice of coordinate systems and a constant precession rate, the equations are also steady. An analytical solution to the derived system of equations is obtained as a sum of eigenfunctions. For a Rossby number of order one or larger it is found that the jet-damping moment is a good approximation to the actual damping moment. For a small Rossby number compared to one we find that the physics changes but the nutation angle is still damped. However, the damping is very sensitive to the motor length and varies from the jet damping value up to values more than an order of magnitude larger. The very large damping is shown to occur as a result of an interaction between the two primary eigenmodes. It is also found that small rates of change of the nutation angle result in correspondingly small changes in the damping moments except at small Rossby number. GRA

N91-27493# Cincinnati Univ., OH.
DIRECT SOLUTION TECHNIQUES FOR VISCOUS FLOW AND THEIR CONTROL Final Report, Oct. 1986 - Apr. 1990
Kirti N. Ghia and Urmila Ghia May 1991 63 p
(Grant AF-AFOSR-0074-87; AF Proj. 2307)
(AD-A236201; AFL-91-5-75; AFOSR-91-0531TR) Avail: NTIS HC/MF A04 CSCL 20/4

Major objectives of this study of two- and three-dimensional low-speed viscous separated flow problems were to understand the effect of flow separation, unsteadiness, three-dimensionality and nonlinear dynamics in simple two- and three-dimensional flows and, subsequently, to examine the control of these flows. Significant effort was directed toward developing basic computational methods which were made available to interested researchers and organizations involved in computational fluid dynamics research. The several analyses developed include two-dimensional Navier-Stokes analyses for steady and unsteady bluff body separation and massively separated flow past generalized airfoils at high angle of attack; a passive flow-control analyses using a flap for a generalized airfoil; active flow control analyses using an oscillating flap modulated suction/injection and free-stream unsteadiness; nonlinear dynamical systems analysis for low-speed separated flows; and, finally, three-dimensional analysis using velocity and vorticity for internal flows. The finite-Re results obtained for steady bluff body separation revealed some anomalies in the existing theoretical models and should help in improving these models. The Navier-Stokes analysis for unsteady separation past a circular cylinder provided very accurate prediction of Reynolds stresses from the first principles. GRA

N91-27494# Ohio Univ., Athens. Dept. of Mechanical Engineering.
STOCHASTIC ESTIMATION OF COHERENT STRUCTURES AND THEIR DYNAMICS IN TRANSITIONAL AND TURBULENT BOUNDARY LAYERS Final Report, Jun. 1989 - Jun. 1990
Y. G. Guezennec, T. J. Gieseke, and N. Trigui 24 Apr. 1991 93 p
(Grant AF-AFOSR-0434-89; AF Proj. 2307)
(AD-A236231; AFOSR-91-0511TR) Avail: NTIS HC/MF A05 CSCL 20/4

The structure of transitional and turbulent boundary layers was investigated experimentally using the stochastic estimation technique. The two-point space-time full correlation tensor was measured at various Reynolds numbers in the near wall region of a boundary layer, and the outer region of a regular and LEBU manipulated boundary layer. It was found that multi-point stochastic estimates yield a far more realistic picture of the turbulent structures than conventional one-point conditional averages. A new technique was developed, whereby the pseudo-dynamic evolution of the flow field is reconstructed by means of the stochastic estimation for a measured time sequence of velocity at one or more points. This yields a very realistic kinematic evolution of the flow structures. Prospects for deriving dynamical evolution equations for the stochastic estimates were also explored. GRA

N91-27495# Michigan State Univ., East Lansing.
EFFECTS OF EXTERNAL FORCING ON ENTRAINMENT RATIO AND FLUID COMPOSITION IN TURBULENT SHEAR LAYERS Final Technical Report, 1 Sep. 1987 - 31 Aug. 1990
M. M. Koochesfahani and C. G. MacKinnon 14 Feb. 1991 52 p
(Grant AF-AFOSR-0332-87; AF Proj. 2307)
(AD-A236487; AFOSR-91-0509TR) Avail: NTIS HC/MF A04 CSCL 20/4

The objective was to determine how the imposition of 2-D external disturbances affects the mixing field in plane two-stream shear layers. The study relates to the effects of forcing on mixing of species, the kind of mixing that is necessary for chemical reaction and combustion. The effect of forcing on mixing was documented by measuring the probability density function (pdf) of the concentration field in a nonreacting liquid shear layer forced by 2-D disturbances. The concentration field was measured using the laser induced fluorescence (LIF) technique in the passive scalar mode. Results show that composition distribution of mixed fluid in forced shear layers is essentially uniform across the width of the shear layer similar to previous results in natural layers. Forcing changes both the amount and the composition of mixed fluid. For the cases studied, forcing results in an increase of the total amount of mixed fluid (integrated across the layer width) and a shift of the predominant mixed-fluid concentration to larger values. The increase in the amount of mixing in the forced layer appears to be due mostly to the increase in the layer width and not so much the result of improved small scale mixing. Details of the forcing waveform shape have a significant influence on the structure of the flow and the mixing field. GRA

N91-27496# Maryland Univ., College Park.
MULTIBURST AND FRATRICIDE EFFECTS. TASK 1: NUMERICAL METHODS AND COMPUTATIONAL RESULTS Technical Report, 29 Sep. 1987 - 31 Oct. 1990
Harland M. Glaz 1 Jun. 1991 32 p
(Contract DNA001-87-C-0303)
(AD-A236498; DNA-TR-90-199-Task-1) Avail: NTIS HC/MF A03 CSCL 20/4

Several developments are documented and summarized in the field of numerical analysis of systems of hyperbolic conservation laws (especially, gas dynamics) and their viscous extensions (especially, the Navier Stokes equations); applications of the methods obtained in larger scale scientific computing with the objective of modeling complex physical phenomena, including careful checks against experimental data; and further applications of the methodology in the modeling of blast wave environments. Of special note are results concerning shear layer and boundary layer phenomenology (the latter including the effects of dust, preheating, etc.) and new methods for multimaterial calculations and problems involving wave speed stiffness (e.g., the early stages of fireball rise). GRA

N91-27497# Army Military Personnel Center, Alexandria, VA.
NUMERICAL SIMULATION OF FLUID FLOW IN A SIMPLE ROTOR/STATOR PAIR M.S. Thesis Final Report, Jan. - Jun. 1991
Joseph J. McVeigh, Jr. Jun. 1991 110 p
(AD-A236720) Avail: NTIS HC/MF A06 CSCL 20/4

A series of numerical experiments are described which deal with rotor/stator interactions in hydroturbines. The means of analysis was a nonconforming sliding spectral element method for the unsteady, incompressible Navier-Stokes equations in two-dimensional geometry. The variable parameter in the simulation was the rotor advance coefficient. A comparison of lifting forces, flow rate, dissipation and kinetic energy was conducted for the various test cases. Robustness of the numerical discretizations was demonstrated by the consistency of the computed results. The divergence, vorticity and streamlines generated during postprocessing were in strong agreement with hydrodynamic theory. A step-by-step procedure is presented for manipulating the working environment (the discrete spectral element control volume) around the rotor-stator pair. The selection criteria for the input parameters and boundary conditions is developed. GRA

N91-27498# Arizona State Univ., Tempe. Dept. of Mechanical and Aerospace Engineering.
THREE-DIMENSIONAL STRUCTURE OF TRANSITIONAL BOUNDARY-LAYERS Final Report, 15 Jun. 1985 - 30 Sep. 1989
William S. Saric Sep. 1990 13 p
(Contract F49620-85-C-0089)
(AD-A236762; AFOSR-91-0508TR) Avail: NTIS HC/MF A03 CSCL 20/4

Experiments were performed of boundary layers undergoing instabilities and transition to turbulence. The experiments used multiple hot-wire anemometer techniques to study the origin and evolution of the characteristic large-scale structures of transitional boundary layers. Fundamental transition mechanisms, the control of random background disturbances, and the receptivity of the boundary layer to external disturbances that lead to transition were studied. This work lays the foundation for more advanced work in boundary-layer transition and control with sound and 3-D roughness. GRA

N91-27499# Amtec Engineering, Inc., Bellevue, WA.
TURBULENT SWIRLING FLOW IN COMBUSTOR/EXHAUST NOZZLE SYSTEMS Final Report, May 1985 - Jan. 1991

Kelton M. Peery, Scott I. Imlay, and M. Soetrisno 29 Mar. 1991 151 p
(Contract F33615-85-C-2588)
(AD-A236861; WL-TR-91-2011) Avail: NTIS HC/MF A08 CSCL 20/4

A Computer code named DUMPSTER was developed for the analysis of the viscous swirling nonreacting flow in dump combustors closely coupled to convergent divergent nozzles. The development, application, and use of this code is described in this report. DUMPSTER solves the 2D/axisymmetric compressible Navier-Stokes equation with one or more transport equations for trace chemical speicies. Turbulence is modeled with either an algebraic model or a two-equation K-E model. The equations are solved using a time-dependent finite-volume method. The fluxes are calculated using on of the following second-order accurate flux functions: (1) Steger-Warming flux vector splitting, (2) Roe's flux difference splitting, or (3) Harten-yee's Total Variation Diminishing (TVD) Flux. The results of the code agree reasonable well with dump combustor experimental data and other numerical simulation programs. GRA

N91-27500# City Coll. of the City Univ. of New York, NY. Dept. of Physics.
TURBULENT MOLECULAR PROCESSES AND STRUCTURES IN SUPERSONIC FREE SHEAR LAYERS Final Technical Report
Joseph A. Johnson, III 31 Dec. 1990 4 p
(Contract N00014-90-J-1239)
(AD-A236922) Avail: NTIS HC/MF A01 CSCL 20/4

We used our Ludwieg tube-wind-tunnel to determine Reynolds number and Mach number effects on the dynamics of coherent structures in a supersonic free shear layer. We proposed to implement fluorescence in NO2 as a local point density diagnostic and to develop a capacity of simultaneous three dimensional measurements of velocity and Reynolds number histories in the free shear layer and to determine as well the axial and transverse profiles for such a flow. Using a Mach number 2.5 nozzle, we have confirmed our previously published evidence of Reynolds number sensitivity in supersonic turbulent shocklets in compressible free shear layers. We have determined that shocklet-producing entities are low velocity systems in these flows and have impact on the local scales associated with turbulent effects. We have determined a local evolution of coherence in the Reynolds stress data, using both phase coherence velocimetry and new techniques for direct velocity estimations, between the on-axis and off-axis regions of the free shear layer. We find that classical turbulent effects are in a long-wavelength range while effects accompanying chaos are at short wavelengths, -- with fractal dimensions which suggest that the observed chaotic behavior evolves from instabilities in flow which is topologically two dimensional. GRA

N91-27501*# Institute for Computer Applications in Science and Engineering, Hampton, VA.
STABILITY OF A NON-ORTHOGONAL STAGNATION FLOW TO THREE DIMENSIONAL DISTURBANCES Final Report
D. G. Lasseigne and T. L. Jackson (Old Dominion Univ., Norfolk, VA.) Jun. 1991 29 p Submitted for publication
(Contract NAS1-18605)
(NASA-CR-187591; NAS 1.26:187591; ICASE-IR-91-51) Avail: NTIS HC/MF A03 CSCL 20D

A similarity solution for a low Mach number nonorthogonal flow impinging on a hot or cold plate is presented. For the constant density case, it is known that the stagnation point shifts in the direction of the incoming flow and that this shift increases as the angle of attack decreases. When the effects of density variations are included, a critical plate temperature exists; above this temperature the stagnation point shifts away from the incoming stream as the angle is decreased. This flow field is believed to have application to the reattachment zone of certain separated flows or to a lifting body at a high angle of attack. Finally, the stability of this nonorthogonal flow to self similar, 3-D disturbances is examined. Stability properties of the flow are given as a function of the parameters of this study; ratio of the plate temperature to that of the outer potential flow and angle of attack. In particular, it is shown that the angle of attack can be scaled out by a suitable definition of an equivalent wavenumber and temporal growth rate, and the stability problem for the nonorthogonal case is identical to the stability problem for the orthogonal case. Author

N91-27502*# Minnesota Univ., Minneapolis. Dept. of Mechanical Engineering.
FREE-STREAM TURBULENCE AND CONCAVE CURVATURE EFFECTS ON HEATED, TRANSITIONAL BOUNDARY LAYERS Final Report
J. Kim and T. W. Simon Aug. 1991 282 p Sponsored in part by AFOSR
(Grant NAG3-881)
(NASA-CR-187151; NAS 1.26:187151) Avail: NTIS HC/MF A13 CSCL 20D

An experimental investigation of the transition process on flat-plate and concave curved-wall boundary layers for various free-stream turbulence levels was performed. Results show that for transition of a flat-plate, the two forms of boundary layer behavior, identified as laminar-like and turbulent-like, cannot be thought of as separate Blasius and fully-turbulent profiles, respectively. Thus, simple transition models in which the desired quantity is assumed to be an average, weighted on intermittency, of the theoretical laminar and fully turbulent values is not expected to be successful. Deviation of the flow identified as laminar-like from theoretical laminar behavior is shown to be due to recovery after the passage of a turbulent spot, while deviation of the flow identified as turbulent-like from the full-turbulent values is thought to be due to incomplete establishment of the fully-turbulent power spectral distribution. Turbulent Prandtl numbers for the transitional flow, computed from measured shear stress, turbulent heat flux and mean velocity and temperature profiles, were less than unity. For the curved-wall case with low free-stream turbulence intensity, the existence of Gortler vortices on the concave wall within both laminar and turbulent flows was established using liquid crystal visualization and spanwise velocity and temperature traverses. Transition was found to occur via a vortex breakdown mode. The vortex wavelength was quite irregular in both the laminar and turbulent flows, but the vortices were stable in time and space. The upwash was found to be more unstable, with higher levels of u' and u'v', and lower skin friction coefficients and shape factors. Turbulent Prandtl numbers, measured using a triple-wire probe, were found to be near unity for all post-transitional profiles, indicating no gross violation of Reynolds analogy. No evidence of streamwise vortices was seen in the high turbulence intensity case. Author

N91-27503*# Georgia Tech Research Inst., Atlanta. School of Aerospace Engineering.
DEVELOPMENT OF ITERATIVE TECHNIQUES FOR THE SOLUTION OF UNSTEADY COMPRESSIBLE VISCOUS FLOWS Semiannual Progress Report, 14 Feb. - 13 Aug. 1991
Lakshmi N. Sankar and Duane Hixon Aug. 1991 33 p
(Grant NAG1-1217; GTRI Proj. E-16-662)
Avail: NTIS HC/MF A03 CSCL 20D

Efficient iterative solution methods are being developed for the numerical solution of two- and three-dimensional compressible Navier-Stokes equations. Iterative time marching methods have several advantages over classical multi-step explicit time marching schemes, and non-iterative implicit time marching schemes. Iterative schemes have better stability characteristics than non-iterative explicit and implicit schemes. Thus, the extra work required by iterative schemes can also be designed to perform efficiently on current and future generation scalable, missively parallel machines. An obvious candidate for iteratively solving the system of coupled nonlinear algebraic equations arising in CFD applications is the Newton method. Newton's method was implemented in existing finite difference and finite volume methods. Depending on the complexity of the problem, the number of Newton iterations needed per step to solve the discretized system of equations can, however, vary dramatically from a few to several

hundred. Another popular approach based on the classical conjugate gradient method, known as the GMRES (Generalized Minimum Residual) algorithm is investigated. The GMRES algorithm was used in the past by a number of researchers for solving steady viscous and inviscid flow problems with considerable success. Here, the suitability of this algorithm is investigated for solving the system of nonlinear equations that arise in unsteady Navier-Stokes solvers at each time step. Unlike the Newton method which attempts to drive the error in the solution at each and every node down to zero, the GMRES algorithm only seeks to minimize the L2 norm of the error. In the GMRES algorithm the changes in the flow properties from one time step to the next are assumed to be the sum of a set of orthogonal vectors. By choosing the number of vectors to a reasonably small value N (between 5 and 20) the work required for advancing the solution from one time step to the next may be kept to (N+1) times that of a noniterative scheme. Many of the operations required by the GMRES algorithm such as matrix-vector multiplies, matrix additions and subtractions can all be vectorized and parallelized efficiently.
Author

N91-27504* National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, TX.
VARIABLE ORIFICE FLOW REGULATOR Patent
Rollin C. Christianson, inventor (to NASA) (Lockheed Engineering and Sciences Co., Las Cruces, NM.) 4 Jun. 1991 18 p Filed 11 Apr. 1990
(NASA-Case-MSC-21549-1; US-Patent-5,020,774; US-Patent-Appl-SN-507553; US-Patent-Class-251-129.15; US-Patent-Class-251-148; US-Patent-Class-251-205; US-Patent-Class-251-326; US-Patent-Class-251-363; Int-Patent-Class-F16K-31/06; Int-Patent-Class-F16K-3/32) Avail: US Patent and Trademark Office CSCL 20D

A flow regulator for high-pressure fluids at elevated temperatures includes a body having a flow passage extending between inlet and outlet openings. First and second orifice members are arranged in the flow passage so at least one of the orifice members can be moved transversely in relation to the flow passage between one operating position where the two orifice openings are aligned for establishing a maximum flow rate of fluids flowing through the flow passage and at least one other operating position in which the two openings are moderately misaligned with one another for establishing a predetermined reduced flow rate of fluids flowing through the flow passage.
Official Gazette of the U.S. Patent and Trademark Office

N91-27505# Arizona State Univ., Tempe. Center for Energy Systems Research.
HEAT TRANSFER ADDITIVES FOR ABSORPTION COOLING SYSTEM FLUIDS Annual Report, Oct. 1989 - Sep. 1990
B. D. Wood, N. S. Berman, K. Kim, and D. S. C. Chau Feb. 1991 49 p
(Contract GRI-5089-260-1874)
(PB91-182998; ASU-CR-R-91030; GRI-91/0021) Avail: NTIS HC/MF A03 CSCL 20D

An analytical and physical understanding was developed of the various phenomena that could effect the heat and mass transfer in the absorber of an absorption chiller. Emphasis was placed on compiling a comprehensive property data base and doing some simple exploratory experiments. Significant accomplishments include the following: compilation of the thermophysical properties of aqueous LiBr solutions; compilation of interfacial tension, solubility, and vapor pressure for various surfactant candidates; completion of a number of flow visualization experiments using the rotating disk apparatus to study solid-liquid interface for aqueous LiBr, aqueous LiBr + n-octanol and aqueous LiBr + hexadecyltrimethyl ammonium bromide (CTAB); surface tension measurements for aqueous LiBr with and without additives and for solutions of water and n-octanol; flow visualization experiments to observe the surface patterns for a number of aqueous solutions and additions; summary of theories for enhanced heat and mass transfer with additives; and compilation of a falling film bibliography on various subjects of interest.
Author

N91-27506*# National Inst. of Standards and Technology, Gaithersburg, MD. Chemical Engineering Science Div.
HEAT TRANSFER IN A COMPACT HEAT EXCHANGER CONTAINING RECTANGULAR CHANNELS AND USING HELIUM GAS
D. A. Olson Jan. 1991 99 p
(NASA-CR-188684; NAS 1.26:188684; PB91-184804; NISTIR-3959) Avail: NTIS HC/MF A05 CSCL 20D

Development of a National Aerospace Plane (NASP), which will fly at hypersonic speeds, require novel cooling techniques to manage the anticipated high heat fluxes on various components. A compact heat exchanger was constructed consisting of 12 parallel, rectangular channels in a flat piece of commercially pure nickel. The channel specimen was radiatively heated on the top side at heat fluxes of up to 77 W/sq cm, insulated on the back side, and cooled with helium gas flowing in the channels at 3.5 to 7.0 MPa and Reynolds numbers of 1400 to 28,000. The measured friction factor was lower than that of the accepted correlation for fully developed turbulent flow, although the uncertainty was high due to uncertainty in the channel height and a high ratio of dynamic pressure to pressure drop. The measured Nusselt number, when modified to account for differences in fluid properties between the wall and the cooling fluid, agreed with past correlations for fully developed turbulent flow in channels. Flow nonuniformity from channel-to-channel was as high as 12 pct above and 19 pct below the mean flow.
Author

N91-27507# Queensland Univ., Brisbane (Australia). Dept. of Civil Engineering.
MEASUREMENTS OF FLUCTUATING EFFECTS ON A CIRCULAR CYLINDER IN A UNIFORM FLOW AT SUBCRITICAL REYNOLDS NUMBER, PART 1
G. S. West and C. J. Apelt Jul. 1990 53 p
(PB91-177865; RR-CE-109-Pt-1; ISBN-0-86776-384-1) Avail: NTIS HC/MF A04 CSCL 20D

Experiments were carried out on long, smooth, circular cylinders to establish data on the fluctuating pressure distributions and r.m.s. lift and drag forces in sub-critical flow (10,000 less than R less than 250,000) on an elemental slice of the cylinder. Parametric studies of the effects of variation of Reynolds number, aspect ratio, turbulence of the incident flow, and wind tunnel blockage were undertaken. The results are presented in graphical and tabular form. The work presented here provides a basis for a study of spanwise effects.
Author

N91-27508# Queensland Univ., Brisbane (Australia). Dept. of Civil Engineering.
MEASUREMENTS OF FLUCTUATING EFFECTS ON A CIRCULAR CYLINDER IN A UNIFORM FLOW AT SUBCRITICAL REYNOLDS NUMBER, PART 2
G. S. West and C. J. Apelt Jul. 1990 33 p
(PB91-177873-Pt2; RR-CE-110-Pt-2; ISBN-0-86776-385-X-Pt-2) Avail: NTIS HC/MF A03 CSCL 20D

Spanwise correlations of the forces on two elements of a long, smooth cylinder with end plates were carried out for a range of Reynold numbers and turbulence intensities. The resulting correlation curves are presented. A theory is proposed to use these curves to calculate the lift and drag coefficients of cylinders of finite length. These coefficients have been evaluated, and are presented in graphical form. Spanwise pressure correlations have also been investigated, and their correlation curves are shown. The results apply to aspect ratios from 10 to 50, Reynolds numbers from 10,000 to 250,000, and turbulence intensities between 0.2 percent and 7.5 percent.
Author

N91-27509# Queensland Univ., Brisbane (Australia). Dept. of Civil Engineering.
MEASUREMENTS OF FLUCTUATING EFFECTS ON A CIRCULAR CYLINDER IN A UNIFORM FLOW AT SUBCRITICAL REYNOLDS NUMBER, PART 3
G. S. West and C. J. Apelt Jul. 1990 25 p
(PB91-177881-Pt-3; RR-CE-111-Pt-3; ISBN-0-86776-386-8-Pt-3) Avail: NTIS HC/MF A03 CSCL 20D

Auto-correlations and spanwise cross-correlations of fluctuations in the basic Strouhal frequency of the fluctuating lift have demonstrated that they have common characteristics through the subcritical flow range. Experimental results plot as a single curve. Integral length scales characterizing the three-diminsional eddies have been calculated. Author

N91-28084*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, AL.
ELLIPSOMETRIC MEASUREMENT OF LIQUID FILM THICKNESS
Ki Joon Chang and D. O. Frazier *In* Alabama A & M Univ., NASA-HBCU Space Science and Engineering Research Forum Proceedings 1989 p 134-14 (For primary document see N91-28063 19-99)
Avail: NTIS HC/MF A23 CSCL 20D

N91-28113*# Prairie View Agricultural and Mechanical Coll., TX. Dept. of Mechanical Engineering.
FORCED CONVECTION AND FLOW BOILING WITH AND WITHOUT ENHANCEMENT DEVICES FOR TOP-SIDE-HEATED HORIZONTAL CHANNELS
Ronald D. Boyd, Sr. and Jerry C. Turknett *In* Alabama A & M Univ., NASA-HBCU Space Science and Engineering Research Forum Proceedings 1989 p 363-37 Sponsored in part by NASA. Johnson Space Center (For primary document see N91-28063 19-99)
Avail: NTIS HC/MF A23 CSCL 20D

35 INSTRUMENTATION AND PHOTOGRAPHY

Includes remote sensors; measuring instruments and gages; detectors; cameras and photographic supplies; and holography.

For aerial photography see *43 Earth Resources and Remote Sensing*. For related information see also *06 Aircraft Instrumentation*, and *19 Spacecraft Instrumentation*.

N91-27510*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, OH.
SPRAY MEASUREMENTS OF AEROTHERMODYNAMIC EFFECT ON DISINTEGRATING LIQUID JETS
Robert D. Ingebo 1991 9 p Presented at the 1991 Winter Annual Meeting of ASME, Atlanta, GA, 1-6 Dec. 1991
(NASA-TM-104501; E-6361; NAS 1.15:104501) Avail: NTIS HC/MF A02 CSCL 20D

An experimental investigation was made to determine the effect of atomizing gas mass flux and temperature on liquid jet breakup in sonic velocity gas flow. Characteristic drop size data were obtained by using the following atomizing gases: nitrogen, argon, and helium to breakup water jets in high velocity gas flow. A scattered light scanning instrument developed at Lewis Research Center was used to measure Sauter mean diameter (SMD). The three gases gave a molecular weight range of 4 to 40 and atomizing gas mass flux and temperature were varied from 6 to 50 g/sq cm and 275-400 K, respectively. The ratio of liquid jet diameter to SMD, D(sub 0)/D(sub 32), was correlated with aerodynamic and liquid-surface force ratios, i.e., the product of the Weber and Reynolds number, We Re, the gas to liquid density ratio, rho(sub g)/rho(sub 1) g and also the molecular scale dimensionless group, rho(sub 1)(Vm exp 3)/ mu(sub 1) g, to give the following expression: D(sub 0)/D(sub 32) = 0.90 x 10(exp -8) x (We Re rho sub g/rho sub 1)exp 0.44 x (rho sub 1 Vm exp 3/mu sub 1 g)exp 0.67 where We Re = ((rho sub g)exp 2(D sub 0)exp 2(V sub C)exp3))/ mu sub 1 sigma, mu sub 1 is liquid viscosity, sigma is surface tension, V sub C is the acoustic gas velocity, V sub m is the RMS velocity of gas molecules, and g is the acceleration of gas molecules due to gravity. Good agreement was obtained with atomization theory for liquid-jet breakup in the regime of aerodynamic stripping. Also, due to its low molecular weight and high acoustic velocity, helium was considerably more effective than nitrogen or argon in producing small-droplet sprays with values of D(sub 32) on the order of 5 microns. Author

N91-27511*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, OH.
RESEARCH AND DEVELOPMENT OF OPTICAL MEASUREMENT TECHNIQUES FOR AEROSPACE PROPULSION RESEARCH: A NASA LEWIS RESEARCH CENTER PERSPECTIVE
Daniel J. Lesco 1991 12 p Presented at the Second International Conference on Photomechanics and Speckle Metrology, San Diego, CA, 22-26 Jul. 1991; sponsored by the Society of Photo-Optical Instrumentation Engineers
(NASA-TM-104418; E-6251; NAS 1.15:104418) Avail: NTIS HC/MF A03 CSCL 14B

The applied research effort required to develop new nonintrusive measurement techniques capable of obtaining the data required by aerospace propulsion researchers and of operating in the harsh environments encountered in research and test facilities is discussed and illustrated through several ongoing projects at NASA's Lewis Research Center. Factors including length of development time, funding levels, and collaborative support from fluid-thermal researchers are cited. Progress in developing new instrumentation via a multi-path approach, including NASA research, grant, and government-sponsored research through mechanisms like the Small Business Innovative Research program, is also described. Author

N91-27512# Army Lab. Command, Fort Monmouth, NJ. Electronics Technology and Devices Lab.
THE EFFECTS OF ACCELERATION ON PRECISION FREQUENCY SOURCES (PROPOSED FOR IEEE STANDARDS PROJECT P1193)
John R. Vig, Claude Audoin, Michael M. Driscoll, Erroll P. EerNisse, and Raymond L. Filler Mar. 1991 53 p
(AD-A235470; SLCET-TR-91-3) Avail: NTIS HC/MF A04 CSCL 14/2

The effects of acceleration on quartz and atomic frequency sources are reviewed. The discussion includes: steady-state acceleration effects, gravity change effects, shock effects, and vibration effects. The vibration effects section includes: sinusoidal vibration, random vibration, acoustic noise, the effects of frequency multiplication, small and large modulation indexes, the effects on short term stability, and spectral responses at other than the vibration frequency. Guidelines are provided for the specification and testing of oscillator acceleration sensitivities. GRA

N91-27513# Quest Integrated, Inc., Kent, WA.
NONCONTACT SMALL-DIAMETER-BORE GAUGE Final Report, 31 May - 13 Nov. 1990
M. A. Lind and R. F. Johnson Oct. 1990 37 p
(Contract F04704-90-C-0033)
(AD-A235675; QUEST-TR-510; BMO-TR-90-127) Avail: NTIS HC/MF A03 CSCL 14/2

Current Peacekeeper and small ICBM guidance systems require measurement tolerances of 5 microinches on bores used in critical bearings in the SFIR (Specific Force Integrating Receiver) and TGG (Third Generation Gyro). A Phase 1 program investigated the feasibility of developing a noncontact measurement system based on the principLe of optical triangulation for characterizing the diameter and cylindricity of these bores. The study showed that the fundamental limitations to the measurement technique are in sub-microinch range. A first prototype probe was constructed and used to demonstrate the measurement of internal diameters to the resolution limit of the A/D converters employed (8 microinches). Once developed, the proposed probe will allow easy measurement of the internal dimensions of cylindrical shapes. This tool would have wide applications as a generic precision measuring tool. GRA

N91-27514# Cornell Univ., Ithaca, NY.
SOLID STATE QUANTUM YIELD DETERMINATION OF A NOVEL BASE PHOTOGENERATOR
James F. Cameron and Jean M. Frechet 4 May 1991 18 p
(Contract N00014-91-J-1338)
(AD-A235686; TR-4) Avail: NTIS HC/MF A03 CSCL 07/3

The photoefficiency of a new class of base photogenerating materials, based on the photoremoval of the alpha, alpha-dimethyl 3,5-dimethoxybenzyloxycarbonyl (Ddz) group from masked amine type bases, was investigated. The solid state quantum yield for the photogeneration of cyclohexylamine from its corresponding Ddz carbamate was evaluated at 280 nm using a number of quantitative infrared methods. A value of 0.10 was found using the optimal method involving a comparison of the intensities of a strong infrared reference band solely associated with the polymer matrix with the decreasing carbonyl absorption of the Ddz substrate. Comparable quantum yields were also found by using an intense band associated with the Ddz masked amine, thus indicating the overall applicability and reliability of the method provided careful choice of the reference band was made. The value of the quantum efficiency for the photo deprotection of Ddz masked amines is sufficiently high for practical applications requiring the use of photogenerated base. GRA

N91-27515# Northwestern Univ., Evanston, IL.
OSSE DATA FLOW AND ANALYSIS
Mark S. Strickman, David Grabelsky, Steven Matz, James Pendleton, and Robert Cameron 1990 11 p
(Contract N00173-85-C-2501)
(AD-A236224) Avail: NTIS HC/MF A03 CSCL 18/4

The Oriented Scintillation Spectrometer Experiment (OSSE) consists of four large volume NaI detectors that are optimized to observe gamma-rays in the 0.05 to 10.0 MeV energy band. Each detector can be oriented independently and has a wide variety of observation and telemetry modes, leading to a complex data analysis environment. The OSSE data analysis task is rendered even more complicated by the on-orbit environment, which exhibits a rich set of variations as a function of energy, point direction, orbital phase and total time in orbit. Since the typical OSSE signal to noise ratio is very low, understanding and accounting for background variations is a critical and complex task. In order to deal with the OSSE data analysis challenge, a system of databases and software have been developed. These include a series of well defined data products that are handled first by a production data analysis system performing routine processing and then by a scientific analysis system which allows individual scientists to examine and manipulate OSSE data. GRA

N91-27516# Northwestern Univ., Evanston, IL.
THE ORIENTED SCINTILLATION SPECTROMETER EXPERIMENT (OSSE) INSTRUMENT DESCRIPTION
W. N. Johnson, J. D. Kurfess, R. L. Kinzer, W. R. Purcell, and Mark S. Strickman 1989 17 p Prepared in cooperation with Universities Space Research Association, Washington, DC, Applied Research Corporation, Washington, DC, Clemson University, Clemson, SC, and the Royal Aerospace Establishment, Farnborough, England
(Contract N00173-85-C-2501)
(AD-A236225) Avail: NTIS HC/MF A03 CSCL 14/2

The Oriented Scintillation Spectrometer Experiment (OSSE) is one of four experiments on NASA's Gamma Ray Observatory (GRO) satellite. GRO, as one of NASA's Great Observatories, will provide coordinated observation which cover six decades of energy in the gamma-ray range. OSSE has been designed to undertake comprehensive gamma-ray observations of astrophysical sources in the 0.05 to 10 MeV energy range. The instrument includes secondary capabilities for gamma-ray and neutron observations above 10 MeV that will be of particular value for solar flare studies. OSSE's observations will address a broad range of objectives in gamma ray astronomy, including a search for evidence of heavy element nucleosynthesis through observation of radioactivity in supernova remnants, and a search for the power source in novae from observations of the associated radioactivity. GRA

N91-27517# Northwestern Univ., Evanston, IL.
SCIENTIFIC OBJECTIVES OF THE ORIENTED SCINTILLATION SPECTROMETER EXPERIMENT (OSSE)
J. D. Kurfess, W. N. Johnson, R. L. Kinzer, M. D. Leising, and G. H. Share 1989 12 p Prepared in cooperation with Universities Space Research Association, Washington, DC, Clemson University, Clemson, SC, Royal Aerospace Establishment, Farnborough, England, and the Applied Research Corporation, Washington, DC
(Contract N00173-85-C-2501)
(AD-A236226) Avail: NTIS HC/MF A03 CSCL 14/2

The Oriented Scintillation Spectrometer Experiment (OSSE) will undertake a broad range of scientific observations in the 0.05 to 10 MeV energy region. These include observations of supernovae and SN remnants, novae, collapsed objects (neutron stars, black holes, and white dwarfs), other galactic discrete and diffuse emissions, gamma-ray burst sources, active galactic nuclei, solar flares, and the opportunity for a partial or complete sky survey. OSSE will provide a line gamma-ray sensitivity of .00002 to .00005 photons/ sq. cm. for 1 million-second observation and a corresponding continuum sensitivity of less than .005 Crab. For the initial sky survey comprised of two-week viewing periods, OSSE will undertake detailed investigations of about 50 targets per year. Examples of the capabilities of OSSE to meet several of these scientific objectives are discussed and the tentative observation program for the first 15 months of the mission is presented. Opportunities for Guest Investigations using OSSE are also discussed. GRA

N91-27518# Naval Postgraduate School, Monterey, CA.
TRANSFORMATION OF A FINITE-ELEMENT MODEL OF A PIEZOELECTRIC SPHERICAL SHELL TRANSDUCER FROM A NODAL TO A SPHERICAL HARMONIC FUNCTION REPRESENTATION M.S. Thesis
Kathleen A. McLean Jun. 1990 66 p
(AD-A236838) Avail: NTIS HC/MF A04 CSCL 17/1

A new method of array modeling which will be used to predict the performance of low frequency active sonar arrays is being investigated. In support of this effort, a network representation of a spherical shell piezoelectric transducer was developed. The transducer was modeled using the finite element code, MARTSAM, from which a nodal description of the transducer was obtained. A procedure was developed to reduce and transform the nodal description of the transducer into a spherical harmonic description. The spherical harmonic description of the transducer was computed at two frequencies, 112.5 Hz and 1125.3 Hz, corresponding to values of ka of 0.1 and 1.0, respectively, where a is the radius of the sphere. GRA

N91-27519# Department of the Navy, Washington, DC.
CONTAMINATION CAPACITANCE PROBE SYSTEM Patent Application
Thomas OConnell, inventor (to Navy) and Thomas Frank, inventor (to Navy) 9 Oct. 1990 11 p
(AD-D014912; US-Patent-Appl-SN-594537) Avail: NTIS HC/MF A03 CSCL 14/2

A contamination capacitance probe system is disclosed that capacitively monitors whether or not two or more fluids or materials that have to remain separated have been mixed or mingled and that provides first and second control signals respectively representative of the unmingled and mingled conditions. The system includes a capacitance sensor constituted by spaced-apart first and second capacitor plates of preselected size and spacing. The plate size and spacing is selected to render negligible any effect that the different materials or fluids or materials might have on the capacitance of the sensor. Circuit means are disclosed that includes a capacitance to frequency convertor, a frequency to voltage convertor, and a Schmidt trigger operative to provide the first and second control signals. The contamination capacitance probe system of the present invention is operable with any two or more fluids or materials having different dielectric constants and that are either immiscible or miscible. GRA

N91-27520*# Southwest Research Inst., San Antonio, TX. Instrumentation and Space Research Div.
THERMAL ANALYSIS OF THE ULTRAVIOLET IMAGER CAMERA AND ELECTRONICS Final Report, May - Aug. 1991
Gregory J. Dirks 11 Jul. 1991 69 p Sponsored in part by NASA, Washington
(NASA Order H-10857-D; SwRI Proj. 15-3799)
(NASA-CR-188665; NAS 1.26:188665) Avail: NTIS HC/MF A04 CSCL 14B

The Ultraviolet Imaging experiment has undergone design changes that necessiate updating the reduced thermal models (RTM's) for both the Camera and Electronics. In addition, there are several mission scenarios that need to be evaluated in terms of thermal response of the instruments. The impact of these design changes and mission scenarios on the thermal performance of the Camera and Electronics assemblies is discussed. Author

N91-27521*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, OH.
HIGH-SPEED LASER ANEMOMETRY BASED ON SPECTRALLY RESOLVED RAYLEIGH SCATTERING
Richard G. Seasholtz 1991 9 p Presented at the Fourth International Conference on Laser Anemometry, Cleveland, OH, 5-9 Aug. 1991; sponsored by ASME, the European Association for Laser Anemometry, Case Western Reserve Univ., Cleveland State Univ. and Ohio Aerospace Institute
(NASA-TM-104522; E-6395; NAS 1.15:104522) Avail: NTIS HC/MF A02 CSCL 14B

Laser anemometry in unseeded flows based on the measurement of the spectrum of Rayleigh scattered laser light is reviewed. The use of molecular scattering avoids the well known problems (particle lag, biasing effects, seed generation, seed injection) of seeded flows. The fundamental limits on velocity measurement accuracy are determined using maximum likelihood methods. Measurement of the Rayleigh spectrum with scanning Fabry-Perot interferometers is analyzed and accuracy limits are established for both single pass and multipass configurations. Multipass configurations have much higher selectivity and are needed for measurements where there is a large amount of excess noise caused by stray laser light. It is shown that Rayleigh scattering is particularly useful for supersonic and hypersonic flows. The results of the analysis are compared with measurements obtained with a Rayleigh scattering diagnostic developed for study of the exhaust plume of a small hydrogen-oxygen rocket, where the velocities are in the range of 1000 to 5000 m/sec. Author

N91-27522* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, MD.
VISUAL AID FOR THE HEARING IMPAIRED Patent
Murzban D. Jhabvala, inventor (to NASA) and Hung C. Lin, inventor (to NASA) (Maryland Univ., College Park.) 2 Jul. 1991 14 p Filed 9 Jun. 1989
(NASA-Case-GSC-13027-1-CU; US-Patent-5,029,216; US-Patent-Appl-SN-363807; US-Patent-Class-381-68.1; US-Patent-Class-381-26; US-Patent-Class-381-92; Int-Patent-Class-H04R-25/00) Avail: US Patent and Trademark Office CSCL 14B

A multichannel electronic visual aid device which is able to signal to the user whether sound is coming from the left or right, front or back, or both is presented. For the plurality of channels, which may operate in pairs, the sound is picked up by a respective microphone and amplified and rectified into a DC voltage. The DC voltage is next fed to an analog to digital converter and then to a digital encoder. The binary code from the encoder is coupled into a logic circuit where the binary code is decoded to proved a plurality of output levels which are used to drive an indicator which, in turn, provides a visual indication of the sound level received. The binary codes for each pair of channels are also fed into a digital comparator. The output of the comparator is used to enable the logic circuits of the two channels such that if, for example, the signal coming from the right is louder than that coming from the left, the output of the logic unit of the right channel will be enabled and the corresponding indicator activated, indicating the sound source on the right. An indication of the loudness is also provided. One embodiment of the invention may be carried by the hearing impaired or deaf, as a system which is embedded into eye glasses or a cap. Another embodiment of the invention may be integrated with a vehicle to give a hearing impaired or deaf driver a warning, with a directional indication, that an emergency vehicle is in the vicinity. In this second embodiment, the emergency vehicle transmits a radio frequency signal which would be used as an enabling signal for the visual aid device to avoid false alarms from traffic and other sound sources in the vicinity of the driver's vehicle.

Official Gazette of the U.S. Patent and Trademark Office

N91-27523*# National Aeronautics and Space Administration. Langley Research Center, Hampton, VA.
LASER TRANSIT ANEMOMETER AND PITOT PROBE COMPARATIVE MEASUREMENTS IN A SHARP CONE BOUNDARY LAYER AT MACH 4
W. W. Hunter, Jr., S. L. Ocheltree, and C. E. Russ, Jr. Jul. 1991 94 p
(NASA-TM-104101; NAS 1.15:104101) Avail: NTIS HC/MF A05 CSCL 14B

Laser transit anemometer (LTA) measurements of a 7 degree sharp cone boundary layer were conducted in the Air Force/AEDC Supersonic Tunnel A Mach 4 flow field. These measurements are compared with Pitot probe measurements and tricone theory provided by AEDC staff. Measurements were made both in laminar and turbulent boundary layers of the model. Comparison of LTA measurements with theory showed agreement to better than 1 percent for the laminar boundary layer cases. This level of agreement was obtained after small position corrections, 0.01 to 0.6 mm, were applied to the experimental data sets. Pitot probe data when compared with theory also showed small positioning errors. The Pitot data value was also limited due to probe interference with the flow near the model. The LTA turbulent boundary layer data indicated a power law dependence of 6.3 to 6.9. The LTA data was analyzed in the time (Tau) domain in which it was obtained and in the velocity domain. No significant differences were noted between Tau and velocity domain results except in one turbulent boundary layer case. Author

N91-27524*# Florida State Univ., Tallahassee. Fluid Mechanics Research Lab.
THE DEVELOPMENT OF LASER SPECKLE VELOCIMETRY FOR THE STUDY OF VORTICAL FLOWS
A. Krothapalli Jul. 1991 117 p
(Grant NAG2-314)
(NASA-CR-177589; A-91187; NAS 1.26:177589) Avail: NTIS HC/MF A06 CSCL 14B

A research program was undertaken to develop a new experimental technique commonly known as particle image displacement velocity (PIVD) to measure an instantaneous two dimensional velocity field in a selected plane of flow field. This technique was successfully developed and applied to the study of several aerodynamic problems. A detailed description of the technique and a broad review of all the research activity carried out in this field are reported. A list of technical publications is also provided. The application of PIDV to unsteady flows with large scale structures is demonstrated in a study of the temporal evolution of the flow past an impulsively started circular cylinder. The instantaneous two dimensional flow in the transition region of a rectangular air jet was measured using PIDV and the details are presented. This experiment clearly demonstrates the PIDV capability in the measurement of turbulent flows. Preliminary experiments were also conducted to measure the instantaneous flow over a circular bump in a transonic flow. Several other experiments now routinely use PIDV as a non-intrustive measurement technique to obtain instantaneous two dimensional velocity fields. Author

N91-27525# National Oceanic and Atmospheric Administration, Boulder, CO. Wave Propagation Lab.
CALIBRATION OF GROUND-BASED MICROWAVE RADIOMETERS FOR ATMOSPHERIC REMOTE SENSING
M. T. Decker and J. A. Schroeder Apr. 1991 22 p (PB91-183111; NOAA-TM-ERL-WPL-197) Avail: NTIS HC/MF A03 CSCL 14B

Two procedures used routinely at the NOAA Wave Propagation Laboratory to calibrate ground based microwave radiometers are described. One technique uses colocated radiosonde data with an atmospheric absorption model to calculate the absolute value of atmospheric radiation that should be observed. The other technique uses the known dependence of radiation on elevation angle to calibrate the radiometer equation that is used to convert instrument voltages and temperatures to a measurment of downwelling atmospheric radiation is derived and its implementation is discussed. GRA

N91-27526# Environmental Protection Agency, Cincinnati, OH. Office of Research and Development.
ULTRASONIC FLOWMETERS THAT ARE INSENSITIVE TO SUSPENDED SOLIDS
William J. Averett 1990 17 p Presented at the ISA/89 International Conference, Philadelphia, PA, 22-28 Oct. 1989 (PB91-162404; EPA/600/D-90/225) Avail: NTIS HC/MF A03 CSCL 14B

The results of an investigation of the performance of state of the art and standard porable ultrasonic Doppler flowmeters that do not require particles or bubbles in the fluid to make an accurate measurement are described. Both the standard and new state of the art flowmeters measured flow within their claimed accuracy in tap water without any particles of bubbles added. All testing was performed at the U.S. EPA Test and Evaluation Facility in Cincinnati, Ohio. All testing conformed to Scientific Apparatus Makers Association (SAMA) standards. The test results from both flowmeters are presented so that an easy comparison may be made and that the improvement in performance can be determined. The velocity range of all testing was from 0-21.58 ft/second. The state of the art ultrasonic flowmeter was superior in measuring lower values of flow and performed about the same as the control flow meter over the upper range of the velocities tested. However, these advancements in ultrasonic technology do not abrogate the normal loss of accuracy above 16.25 ft/second in tap water. The loss seems to be a function of Reynolds number. GRA

N91-27965# Gunma Univ., Maebashi (Japan). Dept. of Electronic Engineering.
TIME RESOLVED ELECTRON SPECTRUM ANALYZER
Katsumi Hirano, Toshikazu Yamamoto, Kouji Asami, and Makoto Shindo *In* National Inst. for Fusion Science, Proceedings of a Workshop on Emissions from Heavy Current Carrying High Density Plasma and Diagnostics May 1991 p 21-39 (For primary document see N91-27962 19-75)
Avail: NTIS HC/MF A06

N91-28076*# Morgan State Univ., Baltimore, MD. Dept. of Physics.
MATHEMATICAL MODELS FOR FILM SENSITIVITY MEASUREMENTS
Ernest C. Hammond, Jr. and Gerald R. Baker *In* Alabama A & M Univ., NASA-HBCU Space Science and Engineering Research Forum Proceedings 1989 p 69-76 (For primary document see N91-28063 19-99)
Avail: NTIS HC/MF A23 CSCL 14E

N91-28102*# Morgan State Univ., Baltimore, MD. Dept. of Physics.
A DENSITOMETRIC ANALYSIS OF IIaO FILM FLOWN ABOARD THE SPACE SHUTTLE TRANSPORTATION SYSTEM STS #3, 7, AND 8
Ernest C. Hammond, Jr. *In* Alabama A & M Univ., NASA-HBCU Space Science and Engineering Research Forum Proceedings 1989 p 283-29 (For primary document see N91-28063 19-99)
Avail: NTIS HC/MF A23 CSCL 14E

N91-28119*# Morgan State Univ., Baltimore, MD. Dept. of Physics.
A DENSITOMETRIC ANALYSIS OF COMMERCIAL 35mm FILMS
Ernest C. Hammond, Jr. and Christopher Ruffin, III *In* Alabama A & M Univ., NASA-HBCU Space Science and Engineering Research Forum Proceedings 1989 p 409-42 (For primary document see N91-28063 19-99)
Avail: NTIS HC/MF A23 CSCL 14E

N91-28120*# National Aeronautics and Space Administration. Langley Research Center, Hampton, VA.
DEVELOPMENT OF FLASHLAMP-PUMPED Q-SWITCHED Ho:Tm:Cr:YAG LASERS FOR MID-INFRARED LIDAR APPLICATION
Young S. Choi, Kyong H. Kim, Donald A. Whitney (Hampton Univ., VA.), Robert V. Hess, Norman P. Barnes, Clayton H. Bair, and Philip Brockman *In* Alabama A & M Univ., NASA-HBCU Space Science and Engineering Research Forum Proceedings 1989 p 422-42 (For primary document see N91-28063 19-99)
(Grant NAG1-877)
Avail: NTIS HC/MF A23 CSCL 14E

N91-28125*# Morgan State Univ., Baltimore, MD. Dept. of Physics.
PARAMETERS OF TENSILE STRENGTH, ELONGATION, AND TENACITY OF 70mm IIaO SPECTROSCOPIC FILM
Ernest C. Hammond, Jr. and Kevin A. Peters *In* Alabama A & M Univ., NASA-HBCU Space Science and Engineering Research Forum Proceedings 1989 p 479-48 (For primary document see N91-28063 19-99)
Avail: NTIS HC/MF A23 CSCL 14E

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Includes parametric amplifiers.
For related information see also *76 Solid-State Physics.*

N91-27527# National Inst. of Standards and Technology, Boulder, CO.
LASER INDUCED DAMAGE IN OPTICAL MATERIALS: 1989
H. E. Bennett, L. L. Chase, A. H. Guenther, B. E. Newnam, and M. J. Soileau Oct. 1990 674 p Prepared for presentation at the 21st Optical Materials for High-Power Lasers, Boulder, CO, 1-3 Nov. 1989 Prepared in cooperation with American Society for Testing and Materials, Philadelphia, PA; and International Society for Optical Engineering, Bellingham, WA
(PB91-148478; NIST/SP-801) Avail: NTIS HC/MF A99; also available SOD HC $30.00 as 003-003-03061-9 CSCL 20E

The 21st Annual Symposium on Optical Materials for High Power Lasers was divided into sessions concerning Materials and Measurements, Mirrors and Surfaces, Thin Films, and, finally, Fundamental Mechanisms. As in previous years, the emphasis of the papers presented was directed toward new frontiers and new developments. Particular emphasis was given to materials for high power apparatus. The wavelength range of the prime interest included surface characterization, thin film substrate boundaries, and advances in fundamental laser matter threshold interactions and mechanisms. The scalling of damage thresholds with pulse duration, focal area, and wavelength was discussed in detail.
Author

N91-27528 Department of the Navy, Washington, DC.
METHOD OF LASER DISCRIMINATION USING STIMULATED LUMINESCENCE Patent
Veerendra K. Mathur, inventor (to Navy) and Kishalaya Chakrabarti, inventor (to Navy) 7 Aug. 1990 5 p Filed 25 Jul. 1989 (AD-D014897; US-Patent-4,947,465; US-Patent-Appl-SN-385032; US-Patent-Class-250-484.1) Avail: US Patent and Trademark Office CSCL 17/5

A method of determining the nature of an unspecified laser source using the optically and thermally stimulated luminescence characteristics of a single MgS phosphor doped with either Ce, Sm or Eu, Sm ions. The doped MgS phosphor is first exposed to charging radiation thereby allowing electron trapping, the phosphor is exposed to the energy of an unspecified laser source which frees the trapped electrons. The freed electrons are then available for recombination which results in a specific color luminescence indicative of the type of laser source. GRA

N91-27529# Lawrence Livermore National Lab., CA.
IONIZATION INDUCED FREQUENCY SHIFTS IN SUBPICOSECOND LASER PULSES
B. M. Penetrante and J. N. Bardsley i Feb. 1991 4 p Presented at the 20th International Conference on Phenomena in Ionized Gases, Barga (Italy), 8-12 Jul. 1991
(Contract W-7405-eng-48)
(DE91-010472; UCRL-JC-106473; CONF-910711-3) Avail: NTIS HC/MF A01

A 1-D electromagnetic plasma simulation code was used to provide a more rigorous study of ionization-induced frequency shifts in subpicosecond laser pulses. The objectives are (1) to calculate the relative contributions of field ionization and electron-impact ionization, (2) to study the effect of Coulomb collisions, (3) to test the validity of the Drude model, and (4) to check the sensitivity of the frequency shift and the spectral broadening to the laser parameters and to the properties of the ionized gas. DOE

N91-27530*# Boston Coll., Chestnut Hill, MA. Dept. of Physics.
ENERGY TRANSFER PROCESSES BETWEEN Tm(3+) AND Ho(3+) IN LiYF4 Ph.D. Thesis Final Report
Goenuel Oezen Jul. 1991 204 p
(Grant NAG1-955)
(NASA-CR-187578; NAS 1.26:187578) Avail: NTIS HC/MF A10 CSCL 20E

The spectroscopic properties of the crystal LiYF4 doped with Thulium (Tm) and Holmium (Ho) ions are studied. The basic processes are discussed that regulate the transfer of energy between these two ions in this crystal. In this system Tm is considered the donor ion and the Ho the acceptor ion. Spectral data were obtained on three samples available: LiYF4:Tm(3+) (0.5 percent), LiYF4:Ho(3+) (1 percent), and LiYF4:Tm(3+) (5 percent), Ho(3+) (0.2 percent). Spectral data, which include absorption, luminescence, excitation, and the response to pulsed excitation in a wide range of temperatures, allowed to look at the energy transfer processes by considering the kinetic evolution of the emission of the two ions (donor and acceptor) involved in the process and the basic spectroscopic properties related to them. This inclusive approach has led to the validation of the physical model. Author

N91-27531 Department of the Navy, Washington, DC.
LASER COMMUNICATION SYSTEM WITH WIDE BAND MAGNETOSTRICTIVE MODULATION Patent
Lawrence T. Kabacoff, inventor (to Navy) 26 Feb. 1991 5 p Filed 15 Sep. 1989
(AD-D014878; US-Patent-4,996,692; US-Patent-Appl-SN-408337; US-Patent-Class-372-26) Avail: US Patent and Trademark Office

A laser beam conducted through an optical fiber cable is phase modulated for communication purposes by a signal encoder operative through a source of current to generate a modulated magnetic field applied to a magnetorestrictive sheathing. The magnetorestrictive sheathing is annealed and covers a portion of the fiber cable which undergoes dimensional change to effect modulation. GRA

N91-27532# Physical Sciences, Inc., Andover, MA.
VIBRATIONALLY ASSISTED TRANSFER LASER Final Report, 1 Jul. 1990 - 31 Jan. 1991
S. J. Davis, W. J. Kessler, K. Donohue, and L. G. Piper Mar. 1991 38 p
(Contract F49620-90-C-0045)
(AD-A235479; PSI-2136/TR-1112; AFOSR-91-0467TR) Avail: NTIS HC/MF A03 CSCL 09/3

Described are results from an experimental investigation of a novel concept for the production of a short wavelength chemical laser (SWCL). The most promising approach for producing such a laser is through energy transfer pumping from a chemically produced, metastable species such as NF(a1Delta) and O2(a1Delta). Previous investigations have shown that species such as NF(a) and O2(a) can excite laser candidates such as BiF an IF. Our results show that preparation of the receptor species, e.g., IF(X), in high vibrational levels of the ground state can enhance the energy transfer efficiency dramatically. Our results also indicate that the process, which we call vibrationally assisted transfer laser (VATL), may have general applicability to the development of SWCL devices. GRA

N91-27533# Hawaii Univ., Honolulu. Inst. of Geophysics.
APPLICATIONS OF ADVANCED MULTICHANNEL LASER RAMAN SPECTROSCOPY TO PROBLEMS IN MARINE CHEMISTRY Final Report, 1 Mar. - 31 Dec. 1990
Shiv K. Sharma and Gordon Taylor 23 Apr. 1991 12 p
(Contract N00014-90-J-1771)
(AD-A235504; HIG-RAM-3) Avail: NTIS HC/MF A03 CSCL 14/2

Laser Raman multichannel spectrometry, and Fourier Transform (FT)-Raman techniques were evaluated and applied to the analysis of low levels of inorganic nutrients in seawater. The best results were obtained in analyzing nitrite in seawater with an azo-dye scattering (SERS) with resonance Raman scattering (RRS), i.e., SERRS, technique using silver colloids. The limit of detection of the azo-dye complex of nitrite with visible laser excitation and the SERRS technique is estimated to be 1 nm in basic seawater solutions and 12 nm in the acidic solutions. GRA

N91-27534# California Univ., Irvine. Dept. of Physics.
X RAY LASER Final Technical Report, 1 Aug. 1988 - 31 Jan. 1991
Norman Rostoker and Amnon Fisher 31 Jan. 1991 71 p
(Contract N00014-88-K-2029)
(AD-A236245) Avail: NTIS HC/MF A04 CSCL 09/3

The following subject areas are covered: x-ray laser based on a Z-Theta pinch, a copy of the x-ray laser gain from Bragg reflection in relativistic electron beam channel radiation systems, x-ray laser gain from Bragg reflection coupling in channeled relativistic beam systems, channeling x-ray laser, reduced radiation losses in a channeled-beam x-ray laser by Bragg reflection coupling, and radiation guiding in channeling beam x-ray laser by Bragg reflection coupling. GRA

N91-27535# E-Tek Dynamics, Inc., San Jose, CA.
HETERODYNE LASER MIXER Final Report, Sep. 1988 - Jun. 1990
P. Wen and J. J. Pan Mar. 1991 178 p
(Contract F30602-88-C-0081)
(AD-A236687; RL-TR-91-28) Avail: NTIS HC/MF A09 CSCL 09/3

This report covers the study, design, and testing aspects of two experimental models. One model is a fiber optic communications link and the other model is a microwave mixer replacement. Both models are based upon the heterodyne laser mixer effect. This effect is the use of a laser diode as both an optical source and mixer at the same time. The fiber optic communications link is called an RF/IF fiber optic link. This link could handle two input RF signal ranges by just changing one small circuit. The input RF signal ranges chosen were 4.4-5.0 GHz and 7.25-7.75 GHz. The local oscillator frequency is chosen so that the IF signal is always centered at 70 MHz. The 4.4-5.0 GHz RF/70MHz IF link had a system signal to noise ratio of 104 db/Hz. The 7.25-7.75 GHz RF/70MHz IF link had a signal to noise ratio of 102 db/Hz. The other model, the microwave mixer replacement, had RF and local oscillator inputs in the 2.85-3.15 GHz range. The down converted output or mixer output was at 70 MHz. With inputs both at 7 dbm, the mixer showed a conversion

loss of 7 db, a harmonic distortion of better than 49 dbc and a third order intermodulation produce of less than 49 dbc with signal to noise of 100 db/Hz. GRA

N91-27536# SRI International Corp., Menlo Park, CA.
ULTRAFAST LASER TECHNIQUES Final Report, 15 Feb. 1988 - 14 Feb. 1991
H. Helm, C. H. Becker, H. Bissantz, C. Bordas, and M. J. Dyer 5 Jun. 1991 69 p
(Contract F49620-88-K-0006)
(AD-A236688; AFOSR-91-0532TR) Avail: NTIS HC/MF A04 CSCL 09/3

A subpicosecond wavelength-tunable high-power dye-laser has been developed and used to perform novel experiments on multiphoton ionization and dissociation, allowing us to draw important conclusions about modifications of the excited state structure of atoms and molecules when exposed to intense radiation. The laser system is based on a synchronously-pumped oscillator, a pulse chirping and compression device, and four amplifiers. The near-Gaussian spatial beam profile and high peak power (greater than 10 GW) allow generation of extreme intensities (greater than 1015 W/sq cm) lasting a few hundred femtoseconds, that when combined with wavelength tunability (580-670 nm and 300-330 nm) reach experimental regimes that were previously inaccessible. In molecular hydrogen we have shown for the first time that the intense field affects both the Rydberg and the core electrons prior to ionization. In atomic xenon we found that, over a limited range, the AC Stark shifts of the 4f, 5f, 6s, and 6d levels correspond to the ponderomotive shift of free electrons. We have also performed measurements of the magnitude and temporal dependence of the third-order nonlinear susceptibility of polymers. In another first we employed our laser to photoionize neutral atoms argon-ion-sputtered from various surfaces. The near-unit ionization efficiency provides an almost stochiometric measurement of the surface composition. GRA

N91-27537# Naval Research Lab., Washington, DC.
RECENT ADVANCES IN FREE ELECTRON LASER THEORY Interim Report
C. M. Tang 11 Jun. 1991 21 p
(AD-A236826; NRL-MR-6831) Avail: NTIS HC/MF A03 CSCL 09/3

Free electron lasers (FELs) have advanced to the stage where the experiments may be considered to have verified the essential FEL theories. The future research in FELs will be strongly tied to applications. There exist many types of lasers and optical techniques to obtain the required laser characteristics in the optical regime. FELs can make significant impact in the IR, UV and x-ray regimes, where conventional lasers are limited. Competition with other sources also requires FELs to be compact and user oriented. The theory developments addressing some of these issues will be presented in this paper. GRA

N91-27538# Naval Ocean Systems Center, San Diego, CA.
LASER-BASED DISPLAY TECHNOLOGY DEVELOPMENT AT THE NAVAL OCEAN SYSTEMS CENTER (NOSC)
Thomas Phillips, John Trias, Mark Lasher, Peter Poirier, and Weldon Dahlke May 1991 11 p
(AD-A236968) Avail: NTIS HC/MF A03 CSCL 20/6

For several years, the Naval Ocean Systems Center (NOSC) has been working on the development of laser-based display systems with the goal of upgrading the image quality and ruggedness of shipboard displays. In this paper we report work on our major task of developing a full-color laser-addressed liquid crystal light value (LCLV) projection system. GRA

N91-27967# Nagoya Univ. (Japan). Dept. of Electrical Engineering.
CHARACTERISTICS OF CORONA-PREIONIZED UV TEA LASER
Takeshi Yasuda, Takamitsu Suzuki, Keiji Nakamura, Chobei Yamabe, and Kenji Horii (Toyota Coll. of Technology, Japan) *In* National Inst. for Fusion Science, Proceedings of a Workshop on Emissions from Heavy Current Carrying High Density Plasma and Diagnostics May 1991 p 46-54 (For primary document see N91-27962 19-75)
Avail: NTIS HC/MF A06

N91-28093*# Hampton Univ., VA. Dept. of Physics.
A 10-WATT CW PHOTODISSOCIATION LASER WITH IODO PERFLUORO-TERT-BUTANE
Bagher Tabibi and Demetrius D. Venable *In* Alabama A & M Univ., NASA-HBCU Space Science and Engineering Research Forum Proceedings 1989 p 218-23 (For primary document see N91-28063 19-99)
Avail: NTIS HC/MF A23 CSCL 20E

N91-28097*# Lincoln Univ., PA. Dept. of Physics.
LINCOLN ADVANCED SCIENCE AND ENGINEERING REINFORCEMENT (LASER) PROGRAM
Willie E. Williams *In* Alabama A & M Univ., NASA-HBCU Space Science and Engineering Research Forum Proceedings 1989 p 254-26 Sponsored in part by Department of Education (For primary document see N91-28063 19-99)
(Contract NGT-90020; N00014-83-G-0082)
Avail: NTIS HC/MF A23 CSCL 20E

N91-28116*# Prairie View Agricultural and Mechanical Coll., TX. Dept. of Mechanical Engineering.
SUBCOOLED FREON-11 FLOW BOILING IN TOP-HEATED FINNED COOLANT CHANNELS WITH AND WITHOUT A TWISTED TAPE
Alvin Smith and Ronald D. Boyd, Sr. *In* Alabama A & M Univ., NASA-HBCU Space Science and Engineering Research Forum Proceedings 1989 p 390-39 Sponsored by NASA. Johnson Space Center and Sandia National Labs. (For primary document see N91-28063 19-99)
Avail: NTIS HC/MF A23 CSCL 20E

N91-28117*# Hampton Univ., VA. Dept. of Physics.
XeCl LASER PUMPED IODINE LASER USING t-C4F9I
In Heon Hwang and Kwang S. Han *In* Alabama A & M Univ., NASA-HBCU Space Science and Engineering Research Forum Proceedings 1989 p 398-40 (For primary document see N91-28063 19-99)
(Grant NAG1-441)
Avail: NTIS HC/MF A23 CSCL 20E

37 MECHANICAL ENGINEERING

Includes auxiliary systems (nonpower); machine elements and processes; and mechanical equipment.

N91-27539*# Aerojet-General Corp., Sacramento, CA. Propulsion Div.
LIQUID HYDROGEN TURBOPUMP ALS ADVANCED DEVELOPMENT PROGRAM. VOLUME 1: HOT FIRE UNIT
Bruce Lindley 8 Oct. 1990 51 p
(Contract NAS8-37593)
(NASA-CR-187035; NAS 1.26:187035) Avail: NTIS HC/MF A04 CSCL 13I

The interface criteria for the Turbopump Test article (TPA) and the Component Test Facility located at NASA, Stennis Space Center is defined by this interface Control Document (ICD). TPA ICD Volume 2 is submitted for the Cold Gas Drive Turbopump Test Article, which is generally similar but incorporates certain changes, particularly in fluid requirements and in instrumentation needs. For the purposes of this ICD, the test article consists of the Hot Fire Drive Turbopump mounted on its test cart, readied for installation in the component test facility. It should be emphasized that the LH2 turbopump program is still in its early concept design phase. Design of the turbopump, test cart, and spools are subject to revisions until successful conclusion of the Detail Design Review (DDR). Author

N91-27540*# Draper (Charles Stark) Lab., Inc., Cambridge, MA.
MULTIVARIABLE CONTROL OF THE SPACE SHUTTLE REMOTE MANIPULATOR SYSTEM USING H2 AND H(INFINITY) OPTIMIZATION M.S. Thesis - Massachusetts Inst. of Tech.
Om Prakash, II May 1991 119 p
(Contract NAS9-18147)
(NASA-CR-185661; NAS 1.26:185661; CSDL-T-1083) Copyright Avail: NTIS HC/MF A06 CSCL 13I

Three linear controllers are desiged to regulate the end effector of the Space Shuttle Remote Manipulator System (SRMS) operating in Position Hold Mode. In this mode of operation, jet firings of the Orbiter can be treated as disturbances while the controller tries to keep the end effector stationary in an orbiter-fixed reference frame. The three design techniques used include: the Linear Quadratic Regulator (LQR), H2 optimization, and H-infinity optimization. The nonlinear SRMS is linearized by modelling the effects of the significant nonlinearities as uncertain parameters. Each regulator design is evaluated for robust stability in light of the parametric uncertanties using both the small gain theorem with an H-infinity norm and the less conservative micro-analysis test. All three regulator designs offer significant improvement over the current system on the nominal plant. Unfortunately, even after dropping performance requirements and designing exclusively for robust stability, robust stability cannot be achieved. The SRMS suffers from lightly damped poles with real parametric uncertainties. Such a system renders the micro-analysis test, which allows for complex peturbations, too conservative. Author

N91-27541*# Alabama Univ., Huntsville.
LASER WELDING IN SPACE Final Report
Gary L. Workman and William F. Kaukler 26 Oct. 1989 101 p
Original contains color illustrations
(Contract NAS9-17962)
(NASA-CR-185638; NAS 1.26:185638) Avail: NTIS HC/MF A06; 5 functional color pages CSCL 13I

Solidification type welding process experiments in conditions of microgravity were performed. The role of convection in such phenomena was examined and convective effects in the small volumes obtained in the laser weld zone were observed. Heat transfer within the weld was affected by acceleration level as indicated by the resulting microstructure changes in low gravity. All experiments were performed such that both high and low gravity welds occurred along the same weld beam, allowing the effects of gravity alone to be examined. Results indicate that laser welding in a space environment is feasible and can be safely performed IVA or EVA. Development of the hardware to perform the experiment in a Hitchhiker-g platform is recomended as the next step. This experiment provides NASA with a capable technology for welding needs in space. The resources required to perform this experiment aboard a Shuttle Hitchhiker-pallet are assessed. Over the four year period 1991 to 1994, it is recommended that the task will require 13.6 manyears and $914,900. In addition to demonstrating the technology and ferreting out the problems encountered, it is suggested that NASA will also have a useful laser materials processing facility for working with both the scientific and the engineering aspects of materials processing in space. Several concepts are also included for long-term optimization of available solar power through solar pumping solid state lasers directly for welding power. Author

N91-27542# Wisconsin Univ., Madison. Engine Research Center.
PARTICLE SIZING USING A TWO-DIMENSIONAL IMAGE
P. V. Farrell 1 Mar. 1991 14 p
(Contract DAAL03-86-K-0174)
(AD-A234074; ARO-24623.72-EG-U1R) Avail: NTIS HC/MF A03 CSCL 21/4

Particle size data is available from the scattered light pattern collected by a still camera in a typical Particle Image Velocimetry (PIV) experiment. While most PIV experiments are primarily interested fluid velocities for a seeded flow, in a fuel spray the spray droplets may be used as the scattering particles in dilute areas of the spray. Conventional PIV processing can provide a local average particle velocity in the plane of illumination. In addition, analysis of the scattering signature of the ensemble of particle in a small area of the PIV photograph can provide an average particle size. Examples of the proposed experimental technique are given, as well as a suitable inversion scheme for obtaining particle size distribution from the diffraction pattern using an integral inversion. Author

N91-27543 Department of the Navy, Washington, DC.
HOT AIR HEAT GUN Patent
Terry L. Poston, inventor (to Navy) 5 Mar. 1991 7 p Filed 22 Aug. 1990
(AD-D014885; US-Patent-4,996,972; US-Patent-Appl-SN-570759; US-Patent-Class-126-263) Avail: US Patent and Trademark Office CSCL 13/9

The patents in the preferred embodiment, comprises a heat-shrink comma gun for heat-shrink applications in potentially explosive or flammable conditions, by using a non-electric non-flame producing, and non-sparking heat source. A hand-held housing has a nozzle attached thereto. A heat transfer element is attached within the housing and extends into the nozzle. The space within the nozzle formed between the heat transfer element and the nozzle defines an air heating chamber. A chemically reactive heat cartridge, contained within the heat transfer element, is activated via a striking force. The heat cartridge radiates heat along the heat transfer element into the air heating chamber. Air under pressure is supplied to the air heating chamber and exits the nozzle as hot air under pressure. GRA

N91-27544# Los Alamos National Lab., NM.
ADAPTIVE TRANSFER FUNCTIONS
J. R. Goulding (Portland State Univ., OR.) 1991 7 p Presented at the 1991 International Joint Conference on Neural Networks (IJCNN), Seattle, 8-12 Jul. 1991
(Contract W-7405-eng-36)
(DE91-009968; LA-UR-91-1004; CONF-910779-6) Avail: NTIS HC/MF A02

This paper details the approach and methodology used to build adaptive transfer functions in a feedforward back-propagation neural network, and provides insight into the structure dependent properties of using non-scaled analog inputs. The results of using adaptive transfer functions are shown to outperform conventional architectures in the implementation of a mechanical power transmission gearbox design expert system knowledge base. DOE

N91-27545*# Georgia Inst. of Tech., Atlanta. School of Mechanical Engineering.
ACTIVELY CONTROLLED SHAFT SEALS FOR AEROSPACE APPLICATIONS Semiannual Status Report, Jan. - Jun. 1991
Richard F. Salant 1991 18 p
(Grant NAG3-974)
(NASA-CR-188642; NAS 1.26:188642; E25-666) Avail: NTIS HC/MF A03 CSCL 11A

The main objective is to determine the feasibility of utilizing controllable mechanical seals for aerospace applications. A potential application was selected as a demonstration case: the buffer gas seal in a LOX (liquid oxygen) turbopump. Currently, floating ring seals are used in this application. Their replacement with controllable mechanical seals would result in substantially reduced leakage rates. This would reduce the required amount of stored buffer gas, and therefore increase the vehicle payload. For such an application, a suitable controllable mechanical seal was designed and analyzed. Author

N91-27546*# Illinois Univ., Chicago. Dept. of Mechanical Engineering.
DETERMINATION OF REAL MACHINE-TOOL SETTINGS AND MINIMIZATION OF REAL SURFACE DEVIATION BY COMPUTERIZED INSPECTION Final Report
Faydor L. Litvin, Chihping Kuan, and Yi Zhang Washington Jul. 1991 121 p

(Grant NAG3-965; DA Proj. 1L1-62211-A-47A)
(NASA-CR-4383; E-6267; NAS 1.26:4383; AVSCOM-TR-91-C-021)
Avail: NTIS HC/MF A06 CSCL 13I

A numerical method is developed for the minimization of deviations of real tooth surfaces from the theoretical ones. The deviations are caused by errors of manufacturing, errors of installment of machine-tool settings and distortion of surfaces by heat-treatment. The deviations are determined by coordinate measurements of gear tooth surfaces. The minimization of deviations is based on the proper correction of initially applied machine-tool settings. The contents of accomplished research project cover the following topics: (1) Descriptions of the principle of coordinate measurements of gear tooth surfaces; (2) Deviation of theoretical tooth surfaces (with examples of surfaces of hypoid gears and references for spiral bevel gears); (3) Determination of the reference point and the grid; (4) Determination of the deviations of real tooth surfaces at the points of the grid; and (5) Determination of required corrections of machine-tool settings for minimization of deviations. The procedure for minimization of deviations is based on numerical solution of an overdetermined system of n linear equations in m unknowns (m much less than n), where n is the number of points of measurements and m is the number of parameters of applied machine-tool settings to be corrected. The developed approach is illustrated with numerical examples.
Author

N91-27547*# Catholic Univ. of America, Washington, DC. Dept. of Electrical Engineering.
EXPERIMENTAL STUDY OF TRAJECTORY PLANNING AND CONTROL OF A HIGH PRECISION ROBOT MANIPULATOR Semiannual Progress Report
Charles C. Nguyen and Sami S. Antrazi Aug. 1991 20 p
(Grant NAG5-780)
(NASA-CR-188660; NAS 1.26:188660) Avail: NTIS HC/MF A03 CSCL 13I

The kinematic and trajectory planning is presented for a 6 DOF end-effector whose design was based on the Stewart Platform mechanism. The end-effector was used as a testbed for studying robotic assembly of NASA hardware with passive compliance. Vector analysis was employed to derive a closed-form solution for the end-effector inverse kinematic transformation. A computationally efficient numerical solution was obtained for the end-effector forward kinematic transformation using Newton-Raphson method. Three trajectory planning schemes, two for fine motion and one for gross motion, were developed for the end-effector. Experiments conducted to evaluate the performance of the trajectory planning schemes showed excellent tracking quality with minimal errors. Current activities focus on implementing the developed trajectory planning schemes on mating and demating space-rated connectors and using the compliant platform to acquire forces/torques applied on the end-effector during the assembly task.
Author

N91-27548# State Univ. of New York, Buffalo.
ANALYTICAL AND EXPERIMENTAL MODELING AND CONTROL OF FLEXIBLE STRUCTURES Final Report, Dec. 1987 - Dec. 1990
Daniel J. Inman 30 Jan. 1991 121 p
(Contract F49620-88-C-0018)
(AD-A235523) Avail: NTIS HC/MF A06 CSCL 22/2

Seven major results are summarized. They are: (1) The modeling and experimental verification of closed loop slewing control of flexible structures which has resulted in a substantial improvement in pointing time. (2) The effects of slewing active structures (smart structures) have been modeled, experimentally verified and shown to result in an additional improvement in performance. (3) The nature of control structure interaction has been modeled and experimentally verified for vibration suppression in trusses and for frames using on-board electromagnetic actuators. (4) A Timoshenko model of layered piezoelectric devices has been developed. (5) A significant new model correction method has been developed for adjusting mathematical models based on experimentally obtained data. (6) A robust system identification has been developed; and (7) a dynamic analysis and animation of flexible structures has been developed.
GRA

N91-27549# Wright Research Development Center, Wright-Patterson AFB, OH.
INVESTIGATION INTO THE FAILURE CAUSE OF A DOUBLE ACTING, LEADING EDGE GROOVE, TILTING PAD THRUST BEARING Final Report, Feb. - Aug. 1990
Brian K. Peterson Oct. 1990 56 p
(DA Proj. 668A)
(AD-A235613; WRDC-TR-90-2120) Avail: NTIS HC/MF A04 CSCL 13/9

The results are described of bench tests simulating operation and failure of a thrust bearing used in a gas turbine engine compressor development test rig. The bearing was a double acting, tilting pad with offset pivot, leading edge groove configuration using an AMS 4928 titanium collar and C18200 copper-chrome alloy pads with a No. 2 babbitt face. The bench tests successfully simulated the bearing failure and demonstrated a materials incompatibility. This was supported by visual examination, scanning electron microscopy and X-ray energy spectroscopy. A comparison of the bench test results to the compressor rig bearing failure is provided to support the report conclusions.
GRA

N91-27550# Southwest Research Inst., San Antonio, TX. Fuels and Lubricants Research Facility.
FUEL LUBRICITY REQUIREMENTS FOR DIESEL INJECTION SYSTEMS Interim Report, Sep. 1990 - Feb. 1991
Paul I. Lacey and Sidney J. Lestz Feb. 1991 72 p
(Contract DAAK70-87-C-0043; DA Proj. 1L2-63001-D-150)
(AD-A235972; BFLRF-270) Avail: NTIS HC/MF A04 CSCL 21/4

The U.S. Department of Defense has adopted the single fuel for the battlefield concept. Diesel fuel will be replaced by JP-8/Jet A-1, which has both lower lubricity and viscosity. Currently, the tribological requirements of fuel-lubricated components in the injection system are unknown. As a result, no widely approved lubricity test or standard exists. Similar problems are currently faced in commercial applications where low-sulfur/aromatic fuels are being introduced. The present study details the wear mechanisms likely to exist with low lubricity fuels, with particular reference to injection equipment known to be fuel sensitive. The wear mechanism was found to be a function of contact severity and may not be uniquely defined by a single test. A number of potentially viable lubricity tests is suggested, and fuel/additive components are recommended for wear reduction.
GRA

N91-27551# Naval Civil Engineering Lab., Port Hueneme, CA.
USER DATA PACKAGE FOR COMPRESSED NATURAL GAS (CNG) VEHICLES FOR NAVY APPLICATIONS Final Report, Oct. 1986 - Sep. 1990
Norman L. Helgeson Apr. 1991 137 p
(AD-A235998; NCEL-TN-1829) Avail: NTIS HC/MF A07 CSCL 21/4

Limits on environmental emissions from motor vehicles continue to be reduced by both Federal and local regulatory bodies. The 1990 legislation has established requirements for the use of alternatively fueled fleet vehicles by 1994 in some parts of the country. Also, the availability of petroleum based vehicular fuels is again being questionned. To address these concerns, the Navy undertook experimental operation of a five-vehicle, compressed natural gas (CNG) vehicle fleet. Experience gained in operation of that fleet along with other data available has been used to prepare this user data package. This package provides background information procedures whereby Naval activities can assess the desirability and economic feasibility for implementing a CNG-fueled vehicle fleet. It also provides procedures and recommendations for the design, procurement, and maintenance of both CNG fleet vehicles and CNG refueling stations.
GRA

N91-27552# Army Natick Labs., MA. Research, Development and Engineering Center.
ANALYSIS OF BALLISTICALLY CAUSED DAMAGE IN SOME TEST PANEL FIBERS Final Report, Oct. 1986 - Sep. 1989
Samuel H. Cohen, Robert A. Prosser, Abram King, and C. R. Desper May 1991 45 p
(AD-A236061; NATICK/TR-91/027) Avail: NTIS HC/MF A03 CSCL 19/1

In this report, we describe microscopic and x ray diffraction methods to analyze ballistically induced damage to fibers and yarns within multilayer panels of Spectra 1000 and Spectra 900 polyethylene and Kevlar. Microscopic evaluation by scanning electron microscopy showed heat induced damage in fibers several layers beyond the layer in which the .22 caliber projectile came rest, and x ray diffraction showed crystallinity differences in fibers close to and at some distance from the point of ballistic impact. Polarization microscopy was used to corroborate the x ray diffraction findings, by elucidating differences in birefringence within the fibers. GRA

N91-27553# Carnegie-Mellon Univ., Pittsburgh, PA. Robotics Inst.
THE URANUS MOBILE ROBOT
Mike Blackwell Sep. 1990 35 p
(Contracts N00014-81-0503; N00014-90-J-1656)
(AD-A236593; CMU-RI-TR-91-06) Avail: NTIS HC/MF A03 CSCL 12/9

The Uranus mobile robot was built by Carnegie Mellon University's Mobile Robot Lab to provide a general purpose mobile base to support research in to indoor robot navigation. As a base, it provides full mobility, along with support for a variety of payloads, such as sensors and computers. This report details the design and maintenance of Uranus's mechanical, electrical, and software systems, and is intended to serve two purposes. First, it acts as documentation for the robot. Second, it offers a perspective in to mobile robot design, showing the decision, tradeoffs, and evolution that are involved in the design of a system of this complexity. Hopefully, others building similar systems will be able to profit from our experience. GRA

N91-27554*# Carnegie-Mellon Univ., Pittsburgh, PA. Robotics Inst.
EXPERIMENTAL CHARACTERIZATION OF THE PERCEPTRON LASER RANGEFINDER
I. S. Kweon, Regis Hoffman, and Eric Krotkov Jan. 1991 51 p
(Grant NAGw-1175)
(NASA-CR-188676; NAS 1.26:188676; AD-A236641; CMU-RI-TR-91-01) Avail: NTIS HC/MF A04 CSCL 17/9

In this report, we characterize experimentally a scanning laser rangefinder that employs active sensing to acquire three-dimensional images. We present experimental techniques applicable to a wide variety of laser scanners, and document the results of applying them to a device manufactured by Perceptron. Nominally, the sensor acquires data over a 60 deg x 60 deg field of view in 256 x 256 pixel images at 2 Hz. It digitizes both range and reflectance pixels to 12 bits, providing a maximum range of 40 m and a depth resolution of 1 cm. We present methods and results from experiments to measure geometric parameters including the field of view, angular scanning increments, and minimum sensing distance. We characterize qualitatively problems caused by implementation flaws, including internal reflections and range drift over time, and problems caused by inherent limitations of the rangefinding technology, including sensitivity to ambient light and surface material. We characterize statistically the precision and accuracy of the range measurements. We conclude that the performance of the Perceptron scanner does not compare favorably with the nominal performance, that scanner modifications are required, and that further experimentation must be conducted. GRA

N91-27555# Carnegie-Mellon Univ., Pittsburgh, PA. Robotics Inst.
A COMPOSITE DISCRETE/CONTINUOUS CONTROL OF ROBOT MANIPULATORS
Ju-Jang Lee and Yangsheng Xu Apr. 1991 30 p
(AD-A236642; CMU-RI-TR-91-09) Avail: NTIS HC/MF A03 CSCL 23/3

In this report, a composite control scheme for the control of robot manipulators is proposed. Due to the modeling error or environmental uncertainties, robot motion may present a significant positioning error by using a conventional Computer-Torque Method. To improve tracking capability of robot manipulators, sliding mode control and nonlinear control algorithms have been introduced, but computation is costly, and thus a fast motion execution using simple computer sources is impossible. To solve this problem, we present a composite control algorithm to control robot motion combining a discrete feedforward component and a continuous feedback component. The discrete feedfordward component provides a nominal torque computed using the robot dynamics and compensates for dynamic coupling between the links. This part can be updated in a large sampling time, and can be computed off-line generally; thus real time computation is decreased. The continuous feedback control component uses a structure of Variable Structure System and provides a robust control to disturbances during the sliding mode. This part can be digitally implemented using a short sampling time, and thus a fast motion of a multi-degree freedom robot manipulator can be executed by using a computer, or even a single board computer with an 8-bit CPU. The stability of the proposed multiple-rate control scheme is proven in the paper and efficiency of the control scheme has been demonstrated by simulations of a three-link robot subject to parameter and payload uncertainties GRA

N91-27556# Carnegie-Mellon Univ., Pittsburgh, PA. Robotics Inst.
TORCS: A TELEOPERATED ROBOT CONTROL SYSTEM FOR THE SELF MOBILE SPACE MANIPULATOR
Miyuki Ueno, William Ross, and Mark Friedman Apr. 1991 32 p
(AD-A236821; CMU-RI-TR-91-07) Avail: NTIS HC/MF A03 CSCL 13/9

This document describes the Teleoperated Robot Control System (TORCS) developed to control the Self Mobile Space Manipulator (SM) robot which is being developed in the Vision and Autonomous Systems Center. This robot is a semi-autonomous free-walking system being developed for space applications. TORCS provides a remote operator with comprehensive control of the robot on a number of different levels ranging from traditional teleoperation to completely autonomous walking. The heat of the TORCS system is an interactive, real-time X window based display tool which supports the controls for the robot and displays information on robot position and status. TORCS supports several well-integrated devices for teleoperation including a joystick, a six degree of freedom polhemus, and an isomorphic master controller. The operator can also perform teleoperation by specifying robot joint angles with the workstation mouse. Autonomous features include the ability to take single or multiple steps independently of operator intervention and to plan routes from one location to another. At the highest level, the operator need only specify a destination and TORCS will handle the rest. Provisions are included for the operator to oversee autonomous operations and to interrupt any operation in progress. The TORCS display includes a three-dimensional view of the robot during operations as well as close-up views of the robot gripper and readouts of exact robot status. GRA

N91-27557# Illinois Univ., Urbana. Dept. of Computer Science.
INCREMENTALLY INCREASING THE UNCERTAINTY-TOLERANCE OF ROBOTIC MANIPULATION PLANS
Scott Bennett and Gerald DeJong Apr. 1991 23 p
(Contract N00014-86-K-0309)

(AD-A236852; UIUCDCS-R-91-1685; UILU-ENG-91-1731) Avail: NTIS HC/MF A03 CSCL 12/9

Robotic manipulators control is subject to control and sensing errors which is particularly troublesome in fine motion planning. Several approaches have been taken including propagation of numeric or symbolic uncertainties and generation of plans which use compliant motion to achieve goals in spite of uncertainties. Since approaches have generally sought to guarantee success, plan generation costs are high. We present a new approach to incrementally acquiring uncertainty tolerance in robotic manipulation plans through experience. During plan construction and execution, no reasoning about uncertainty takes place; consequently, plan generation and execution is very fast. However, in response to failures, plans are refined to increase their uncertainty tolerance so as to reduce the future possibility of the encountered failure. The incremental refinement approach has several advantages over guaranteed plans: (1) resulting plans are general and have explicit applicability conditions; (2) plans achieve a savings because they do not explicitly consider uncertainties; (3) savings are obtained over the guaranteed case since often only a subset of all uncertainties lead to failures in practice; and (4) unguaranteed but practical plans can be generated by the incremental approach when they lie outside the scope of the guaranteed planner. To demonstrate our approach we describe an implemented system called GRASPER which learns to grasp novel objects given only imprecise television camera input. GRA

N91-27558*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, OH.

COMPUTERIZED INSPECTION OF REAL SURFACES AND MINIMIZATION OF THEIR DEVIATIONS

Faydor L. Litvin, Y. Zhang, Chihping Kuan (Illinois Univ., Chicago.), and R. F. Handschuh 1991 12 p Presented at the 5th International Conference on Metrology and Properties of Engineering Surfaces, Leicester, England, 10-12 Apr. 1991 Sponsored in part by Gleason Memorial Fund and Dana Corp. Prepared in cooperation with Air Force Systems Command, Cleveland, OH

(Grant NAG3-964; DA Proj. 1L1-6221-A-47A)

(NASA-TM-103798; E-6086; NAS 1.15:103798;

AVSCOM-TR-91-C-008) Avail: NTIS HC/MF A03 CSCL 14D

A method is developed for the minimization of gear tooth surface deviations between theoretical and real surfaces for the improvement of precision of surface manufacture. Coordinate measurement machinery is used to determine a grid of surface coordinates. Theoretical calculations are made for the grid points. A least-square method is used to minimize the deviations between real and theoretical surfaces by altering the manufacturing machine-tool settings. An example is given for a hypoid gear.

Author

N91-27559*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, OH.

SOME PRELIMINARY RESULTS OF BRUSH SEAL/ROTOR INTERFERENCE EFFECTS ON LEAKAGE AT ZERO AND LOW RPM USING A TAPERED-PLUG ROTOR

R. C. Hendricks, M. P. Proctor, J. A. Schlumberger, M. J. Braun, and R. L. Mullen (Case Western Reserve Univ., Cleveland, OH.) 1991 16 p Presented at the 27th Joint Propulsion Conference, Sacramento, CA, 24-27 Jun. 1991; sponsored by AIAA, SAE, ASME and ASEE

(NASA-TM-104396; E-6212; NAS 1.15:104396; AIAA-91-3390) Avail: NTIS HC/MF A03 CSCL 11A

Some preliminary brush seal leakage results for ambient temperature air are presented. Data for four nominal brush rotor radial clearances of -0.09, -0.048, -0.008, and 0.035 mm were taken by using a tapered plug rotor at 0 and 400 rpm with rotor runout of 0.127 mm peak to peak. The brush seal nominal bore diameter was 38 mm with 0.05 mm bristles at 200 bristles/mm of circumference and a 0.61 mm fence height. Leakages were greater than predicted, but agreement was reasonable. Leakage rates were not significantly altered by hysteresis or inlet flow variations. Visualization studies showed that the bristles followed the 400 rpm excitation, and loading studies indicated that bristles slid relative to one another. Author

N91-27560* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, OH.

HIGH-TEMPERATURE, FLEXIBLE, THERMAL BARRIER SEAL Patent

Paul J. Sirocky, inventor (to NASA) and Bruce M. Steinetz, inventor (to NASA) 14 May 1991 13 p Filed 27 Nov. 1989

(NASA-Case-LEW-14672-1; US-Patent-5,014,917;

US-Patent-Appl-SN-441672; US-Patent-Class-239-265.11;

US-Patent-Class-277-34; US-Patent-Class-277-157;

US-Patent-Class-277-226; US-Patent-Class-277-229;

Int-Patent-Class-B64D-33/04; Int-Patent-Class-F16J-15/46)

Avail: US Patent and Trademark Office CSCL 13I

This device seals the sliding interfaces between structural panels that are roughly perpendicular to each other or whose edges are butted against one another. The nonuniformity of the gap between the panels requires significant flexibility along the seal length. The seal is mounted in a rectangular groove in a movable structural panel. A plurality of particles or balls is densely packed in an outer sheathing. The balls are laterally preloaded to maintain sealing contact with the adjacent wall using a pressurized linear bellows. Distortions in the adjacent panel are accommodated by rearrangement of the particles within the outer sheathing. Leakage through the seal is minimized by densely compacting the internal particles and by maintaining positive preload along the back side of the seal. The braid architecture of the outer sheathing is selected to minimize leakage through the seal and to resist mechanical abrasion.

Official Gazette of the U.S. Patent and Trademark Office

N91-27561* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, OH.

QUICK ACTION CLAMP Patent

Frank S. Calco, inventor (to NASA) 16 Jul. 1991 8 p Filed 30 Mar. 1990

(NASA-Case-LEW-14887-1; US-Patent-5,032,045;

US-Patent-Appl-SN-503418; US-Patent-Class-410-80;

US-Patent-Class-410-84; US-Patent-Class-292-60;

US-Patent-Class-292-61; Int-Patent-Class-B60P-7/15;

Int-Patent-Class-E05C-5/04) Avail: US Patent and Trademark Office CSCL 13K

A quick release toggle clamp that utilizes a spring that requires a deliberate positive action for disengagement is presented. The clamp has a sliding bolt that provides a latching mechanism. The bolt is moved by a handle that tends to remain in an engaged position while under tension.

Official Gazette of the U.S. Patent and Trademark Office

N91-27562* National Aeronautics and Space Administration. Langley Research Center, Hampton, VA.

WET SPINNING OF SOLID POLYAMIC ACID FIBERS Patent

William E. Dorogy, Jr., inventor (to NASA) and Anne K. St.Clair, inventor (to NASA) 11 Jun. 1991 9 p Filed 26 Jun. 1990

(NASA-Case-LAR-14489-1; US-Patent-5,023,034;

US-Patent-Appl-SN-543926; US-Patent-Class-264-184;

US-Patent-Class-264-211.15; US-Patent-Class-264-211.16;

US-Patent-Class-264-211.17; US-Patent-Class-264-234;

US-Patent-Class-264-236; US-Patent-Class-264-345) Avail: US Patent and Trademark Office CSCL 13H

The invention is a process for the production of solid aromatic polyamic acid and polyimide fibers from a wet gel or coagulation bath wet gel using N,N-dimethylacetamide (DMAc) solutions of the polyamic acid derived from aromatic dianhydrides such as 3,3',4,4' benzophenonetetra carboxylic dianhydride (BTDA) and aromatic diamines such as 4,4'-oxydianiline (4,4'-ODA). By utilizing the relationship among coagulation medium and concentration, resin inherent viscosity, resin percent solids, filament diameter, and fiber void content, it is possible to make improved polyamic acid fibers. Solid polyimide fibers, obtained by the thermal cyclization of the polyamic acid precursor, have increased tensile

properties compared to fibers containing macropores from the same resin system.

Official Gazette of the U.S. Patent and Trademark Office

N91-27563# Southwest Research Inst., San Antonio, TX.
GAS ROTARY ENGINE TECHNOLOGY DEVELOPMENT Final Report, Apr. - Dec. 1990
T. A. Kuchnicki, B. E. Goodrich, and R. A. Page Dec. 1990 90 p
(Contract GRI-5083-242-0930)
(PB91-182402; SwRI-3458; GRI-91/0096) Avail: NTIS HC/MF A05 CSCL 13I

The feasibility of developing a small natural gas oil cooled rotary engine for long life gas heat pump applications was explored. A literature search was conducted, rotary engine manufacturers were contacted and questionned, experts in engine materials and engine lubricants furnished reports, and discussions were held with engineering management and staff engineers to review rotary engine technology and discuss practical ideas for more durable engine designs. Author

N91-27564# Southwest Research Inst., San Antonio, TX. Dept. of Engine and Vehicle Research.
SUPPLEMENTAL THROTTLELESS OTTO-CYCLE NATURAL GAS ENGINE EXPERIMENTS
J. J. Cole and S. R. King Oct. 1990 214 p
(Contract GRI-5086-233-1442)
(PB91-182576; SwRI-1613-208; GRI-90/0345) Avail: NTIS HC/MF A10 CSCL 13I

A Ford 2.3 liter engine was operated using the throttleless Otto cycle natural gas engine (TONE) control concept, first using an electrical heater and then direct exhaust gas recirculation (EGR) as a source for heating the inlet mixture. Although the TONE concept using the electrical heater showed improved brake thermal efficiency during mid- to full-load operation, the less favorable combustion characteristics of the very lean mixtures necessary for no-load operation in the absence of throttling led to smaller than estimated performance gains at the lowest loads. A decrease in brake thermal efficiency was observed when direct EGR was used as a heat source. Test data are included. Author

N91-27565*# National Inst. of Standards and Technology, Gaithersburg, MD. Robot Systems Div.
RECOMMENDED FINE POSITIONING TEST FOR THE DEVELOPMENT TEST FLIGHT (DTF-1) OF THE NASA FLIGHT TELEROBOTIC SERVICER (FTS)
N. Dagalakis, A. J. Wavering, and P. Spidaliere (National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, MD.) Feb. 1991 124 p
(NASA-CR-188683; NAS 1.26:188683; PB91-185090; NISTIR-4478) Avail: NTIS HC/MF A06 CSCL 13I

Test procedures are proposed for the NASA DTF (Development Test Flight)-1 positioning tests of the FTS (Flight Telerobotic Servicer). The unique problems associated with the DTF-1 mission are discussed, standard robot performance tests and terminology are reviewed and a very detailed description of flight-like testing and analysis is presented. The major technical problem associated with DTF-1 is that only one position sensor can be used, which will be fixed at one location, with a working volume which is probably smaller than some of the robot errors to be measured. Radiation heating of the arm and the sensor could also cause distortions that would interfere with the test. Two robot performance testing committees have established standard testing procedures relevant to the DTF-1. Due to the technical problems associated with DTF-1, these procedures cannot be applied directly. These standard tests call for the use of several test positions at specific locations. Only one position, that of the position sensor, can be used by DTF-1. Off-line programming accuracy might be impossible to measure and in that case it will have to be replaced by forward kinetics accuracy. Author

N91-27566# Sandia National Labs., Albuquerque, NM. Combustion Research Facility
AUTOIGNITION OF METHANE AND NATURAL GAS IN A SIMULATED DIESEL ENVIRONMENT Annual Report, Nov. 1988 - Nov. 1989
R. A. Fraser Dec. 1990 124 p
(Contract GRI-5086-260-1458)
(PB91-167486; GRI-90/0243) Avail: NTIS HC/MF A06 CSCL 20B

The objective is to develop an improved understanding of the processes governing the autoignition of natural gas in a diesel engine type environment. A constant volume combustion vessel is used for the experiments. The autoignition characteristics of methane and natural gas are presented for the pressure and temperature ranges of 5 to 55 atm and 600 to 1700 K (620 to 2600 F), respectively. Comparisons are then made with the autoignition data for methanol, isooctane, and cetane. Two trends are observed. First, there is little effect on the autoignition delay time as the vessel pressure is increased from 5 to 55 atm. Second, there is a slight decrease in the autoignition delay time of methane-ethane gas mixtures as the concentration of ethane is increased. Finally, from a pragmatic view, the use of methane or natural gas as a compression ignited diesel fuel is impractical in a diesel engine without ignition enhancement due to the high compression temperature between 1200 and 1300 K needed to reduce the autoignition delay time to practical values of about 2 ms. GRA

N91-27567# National Inst. of Standards and Technology, Gaithersburg, MD. Robot Systems Div.
ROBOT CHARACTERIZATION TESTING
N. Dagalakis Jan. 1991 19 p
(PB91-167361; NISTIR-4510) Avail: NTIS HC/MF A03 CSCL 13I

Described here is the field of robot characterization, which is broken down into the areas of performance, parameter identification, and environmental interaction. Each area is explored by considering the tests, equipment, and manpower required to characterize the capabilities and performance of robots. Author

N91-27568# California Inst. of Tech., Pasadena. Dynamics Lab.
CONSIDERATIONS FOR THE DESIGN OF GAS-LUBRICATED SLIDER BEARINGS Ph.D. Thesis
P. W. Smith 1988 149 p Sponsored in part by NSF
(PB91-170126; DYNL-89-01) Copyright Avail: NTIS HC/MF A07 CSCL 13H

An approach is developed that simplifies calculation of the dynamic characteristics of a self-acting, gas-lubricated slider bearing system. The technique avoids a lengthy simultaneous solution of the equations of motion of the slider and the time-dependent Reynolds' equation, while providing additional design information that is otherwise unobtainable. The equilibrium pressure distribution in the gas film is obtained using the Bunov-Galerkin formulation of the finite element method. By considering small perturbations of the slider bearing system about equilibrium, two coupled, second-order partial differential equations are derived, which define the in-phase and out-of-phase perturbation pressures in the gas film. These perturbation pressures are integrated to obtain the frequency dependent, nonsymmetrical stiffness and damping matrices for the slider bearing. Using the stiffness and damping properties of the gas bearing and slider support, the equations of motion for the entire slider bearing system are derived. The frequency dependence of the stiffness and damping matrices renders the eigenvalue problem non-linear, and the eigensolutions are obtained iteratively using Brent's method. GRA

N91-27569*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, OH.
SURFACE FATIGUE LIFE OF M50NIL AND AISI 9310 SPUR GEARS AND R C BARS
Dennis P. Townsend and Eric N. Bamberger (General Electric

Co., Cincinnati, OH.) 1991 7 p Presented at the International Conference on Motion and Power Transmissions, Hiroshima, Japan, 24-26 Nov. 1991; sponsored by the Japan Society of Mechanical Engineers with participation of ASME, I. Mech. E., VDI, I.E.T., CSME and other societies
(DA Proj. 1L1-62211-A-47A)
(NASA-TM-104496; E-6353; NAS 1.15:104496;
AVSCOM-TR-91-C-034) Avail: NTIS HC/MF A02 CSCL 13K

Spur gear endurance tests and rolling element surface fatigue tests were conducted to study vacuum induction melted, vacuum arc remelted (VIM-VAR) M50NiL steel for use as a gear steel in advanced aircraft applications, to determine its endurance characteristics, and to compare the results with those for standard VAR and VIM-VAR AISI 9310 gear material. Tests were conducted with spur gears and rolling contact bars manufactured from VIM-VAR M50NiL and VAR and VIM-VAR AISI 9310. The gear pitch diameter was 8.9 cm. Gear test conditions were an inlet oil temperature of 320 K, and outlet oil temperature of 350 K, a maximum Hertz stress of 1.71 GPa, and a speed of 10000 rpm. Bench rolling element fatigue tests were conducted at ambient temperatures with a bar speed of 12,500 rpm and a maximum Hertz stress of 4.83 GPa. The VIM-VAR M50NiL gears had a surface fatigue life that was 4.5 and 11.5 times that for VIM-VAR and VAR AISI 9310 gears, respectively. The surface fatigue life of the VIM-VAR M50NiL rolling contact bars was 13.2 and 21.6 times that for the VIM-VAR and VAR AISI 9310, respectively. The VIM-VAR M50NiL material was shown to have good resistance to fracture through a fatigue spall and superior fatigue life to both other gears. Author

N91-27570*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, OH.
DYNAMIC MEASUREMENTS OF GEAR TOOTH FRICTION AND LOAD
Brian Rebbechi (Australian Aeronautical Research Committee, Melbourne.), Fred B. Oswald, and Dennis P. Townsend 1991 14 p Presented at the Fall Technical Meeting of the American Gear Manufactures Association, Detroit, MI, 21-23 Oct. 1991
(DA Proj. 1L1-62211-A-47A)
(NASA-TM-103281; E-6020; NAS 1.15:103281;
AVSCOM-TR-90-C-023) Avail: NTIS HC/MF A03 CSCL 13K

As part of a program to study fundamental mechanisms of gear noise, static and dynamic gear tooth strain measurements were made on the NASA gear-noise rig. Tooth-fillet strains from low-contact ratio-spur gears were recorded for 28 operating conditions. A method is introduced whereby strain gage measurements taken from both the tension and compression sides of a gear tooth can be transformed into the normal and frictional loads on the tooth. This technique was applied to both the static and dynamic strain data. The static case results showed close agreement with expected results. For the dynamic case, the normal-force computation produced very good results, but the friction results, although promising, were not as accurate. Tooth sliding friction strongly affected the signal from the strain gage on the tensionside of the tooth. The compression gage was affected by friction to a much lesser degree. The potential of the method to measure friction force was demonstrated, but further refinement will be required before this technique can be used to measure friction forces dynamically with an acceptable degree of accuracy. Author

N91-28111*# Central State Univ., Wilberforce, OH. Dept. of Manufacturing Engineering.
SERVOMOTOR-LINKED ARTICULATED VERSATILE END EFFECTOR (SLAVE2)
Abayomi J. Ajayi-Majebi, William A. Grissom, Brian Wingard, and Derrick Walker *In* Alabama A & M Univ., NASA-HBCU Space Science and Engineering Research Forum Proceedings 1989 p 349-35 (For primary document see N91-28063 19-99)
(Contract NAGw-1336; JPL-958292)
Avail: NTIS HC/MF A23 CSCL 13I

38 QUALITY ASSURANCE AND RELIABILITY

Includes product sampling procedures and techniques; and quality control.

N91-27571# Air Force Systems Command, Wright-Patterson AFB, OH. Foreign Technology Div.
NONDESTRUCTIVE TESTING (SELECTED ARTICLES)
25 Feb. 1991 51 p Transl. into ENGLISH from Wusun Jiance (Peoples Rep. of China), v. 11, no. 7, 1989 p 194-205
(AD-A234805; FTD-ID(RS)T-0355-90) Avail: NTIS HC/MF A04 CSCL 20/11

Residual stress measurement method with prospects for nondestructive electrical measurement; magnetic particle inspection of cracks in inside cylinder walls; and methods for radiographic inspection and classification of radiographs for fusion welding butt joints in steel are discussed. B.G.

N91-27572# Sandia National Labs., Albuquerque, NM.
PHYSICAL BASIS FOR NONDESTRUCTIVE TESTS OF MOS RADIATION HARDNESS
J. H. Scofield (Oberlin Coll., OH.) and D. M. Fleetwood 1991 5 p Presented at the IEEE Annual International Nuclear and Space Radiation Effects Conference, San Diego, 15-19 Jul. 1991
(Contract DE-AC04-76DP-00789)
(DE91-009180; SAND-91-0391C; CONF-910751-7) Avail: NTIS HC/MF A01

It is shown that pre-irradiation channel mobility and 1/f-noise measurements can reveal a great deal about postirradiation interface- and oxide-trap charge buildup in MOS transistors. A model is developed to explain the observed correlations. DOE

N91-27573# Department of the Navy, Washington, DC.
NUCLEAR MAGNETIC RESONANCE IMAGING WITH SHORT GRADIENT PULSES Patent Application
David G. Cory, J. B. Miller, and A. N. Garroway, inventors (to Navy) 29 Nov. 1990 22 p
(AD-D014910; US-Patent-Appl-SN-619567) Avail: NTIS HC/MF A03 CSCL 20/5

The present invention is directed to a method and apparatus for nuclear magnetic resonance (NMR) imaging and more particularly to the method and apparatus for intercalating a sequence of magnetic field gradient pulses into a line-narrowing sequence in such a manner as to improve the performance of the imaging procedure. These methods and apparatus are illustrated in the context of imaging solids, but may contribute to NMR imaging in general. GRA

N91-27574# California State Dept. of Transportation, Sacramento. Office of Transportation Lab.
DEVELOPMENT OF ULTRASONIC TECHNIQUES TO ESTABLISH FLAW SIZE Final Report
F. O. Reed Jun. 1990 47 p Sponsored by Federal Highway Administration, Sacramento, CA
(PB91-176271; Rept-636973; FHWA/CAL/TL-90/03) Avail: NTIS HC/MF A03 CSCL 14D

Ultrasonic approaches for determining flaw size and orientation in butt welds, hanger pins, and trunnions were investigated. Cracks can be detected to 1/8 inch depth in hanger plates, hanger pins, and trunnions if the orientation of the crack allows reflected sound to return to a receiving transducer. The orientation of a planar flaw and the diameter of the searching transducer can have the effect of producing a greater maximum amplitude for the smaller planar flaw. Determining the size and orientation of flaws in butt welds is not attainable with off-the-shelf ultrasonic equipment available at this time and with current operator expertise. GRA

N91-27575*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, OH.
ULTRASONIC EVALUATION OF OXIDATION AND REDUCTION EFFECTS ON THE ELASTIC BEHAVIOR AND GLOBAL MICROSTRUCTURE OF YBa2Cu3O7-X

Don J. Roth, Mark R. DeGuire, and Leonard E. Dolhert (Grace, W. R. and Co., Columbia, MD) Jul. 1991 29 p
(NASA-TM-104529; E-6282; NAS 1.15:104529) Avail: NTIS HC/MF A03 CSCL 14D

Ultrasonic velocity measurement techniques were used to evaluate the effects of oxidation and reduction on the elastic properties, global microstructure and oxygen content of the YBa2Cu3O(7-x) ceramic superconductor for samples ranging from 70 to 90 pct. of theoretical density. Bulk density, velocity, and elastic modulus generally increased with increasing oxygen content upon oxidation, and this behavior was reversible. Velocity image patterns were similar after oxidation and reduction treatments for a 90 pct. dense sample, although the velocity value at any given point on the sample was changed following the treatments. The unchanging pattern correlated with destructive measurements showing that the spatial pore distribution (fraction and size) was not measurably altered after the treatments. Changes in superconducting behavior, crystal structure, and grain structure were observed consistent with changes in oxygen content.
Author

39 STRUCTURAL MECHANICS

Includes structural element design and weight analysis; fatigue; and thermal stress.

For applications see *05 Aircraft Design, Testing and Performance* and *18 Spacecraft Design, Testing and Performance.*

N91-27576 State Univ. of New York, Buffalo.
FINITE ELEMENT ANALYSIS FOR CREEP AND RUPTURE OF NONLINEAR VISCOELASTIC MATERIALS Ph.D. Thesis
Sheng-Ann Liu 1990 187 p
Avail: Univ. Microfilms Order No. DA9033714

Creep and creep rupture behavior of both axisymmetric and notched thick walled tubes, subjected to an internal pressure, are studied in detail based on the local continuum damage mechanics approach using the finite element technique. A generalized creep damage law is derived and then employed to evaluate the creep damage of the tubes under investigation. The solution procedure models the development of creep damage, due to the accumulation of creep strain, and involves the repetitive solution for the associated boundary-value problem which consists of two successive time periods of damage. Differences between the creep and creep rupture behaviors for an axisymmetric tube using the steady creep and hardening creep hypotheses are examined. Theoretical durations of both time periods, the associated stress redistribution, and the damage growth are determined. The analyses indicate that the presence of an internal notch not only greatly increases the numerical complexities, but also significantly reduces the creep rupture life. Dissert. Abstr.

N91-27577# Columbia Research Corp., Annapolis, MD.
FATIGUE PERFORMANCE UNDER MULTIAXIAL LOADING Report, May 1988 - May 1989
K. A. Stambaugh, P. R. VanMater, and W. H. Munse Jan. 1990 253 p Sponsored in part by Ship Structure Committee, Washington, and US Coast Guard, Washington
(Contract DTCG23-88-C-20021)
(PB91-153288; Rept-181-01; SSC-356) Avail: NTIS HC/MF A12 CSCL 20K

The environmental loading and structural geometry associated with welded marine structures often produces multiaxial stresses. Large scale welded details were used to characterize multiaxial fatigue response in marine structures; however, cost of these tests is often prohibitive. A review of multiaxial fatigue literature was performed to identify analytical techniques that might be used to predict multiaxial fatigue response. Various approaches are identified and summarized. Supporting literature is referenced. The reliability (bias and scatter) of the multiaxial approaches is presented where available. Various factors influencing multiaxial fatigue response are identified. A welded detail is used as an example to show how multiaxial fatigue life predictions are obtained from unaxial fatigue test data. Finally, research is recommended to facilitate the technology transfer of multiaxial fatigue research to marine structures. GRA

N91-27578*# National Aeronautics and Space Administration. Langley Research Center, Hampton, VA.
EXPERIMENTS FOR LOCATING DAMAGED TRUSS MEMBERS IN A TRUSS STRUCTURE
Paul E. McGowan, Suzanne W. Smith, and Mehzad Javeed (Lockheed Engineering and Sciences Co., Hampton, VA.) May 1991 46 p Presented at the 2nd USAF/NASA Workshop on System Identification and Health Monitoring of Precision Space Structures, Pasadena, CA, 27-29 Mar. 1990
(NASA-TM-104093; NAS 1.15:104093) Avail: NTIS HC/MF A03 CSCL 20K

Locating damaged truss members in large space structures will involve a combination of sensing and diagnostic techniques. Methods developed for damage location require experimental verification prior to on-orbit applications. To this end, a series of experiments for locating damaged members using a generic, ten bay truss structure were conducted. A 'damaged' member is a member which has been removed entirely. Previously developed identification methods are used in conjunction with the experimental data to locate damage. Preliminary results to date are included, and indicate that mode selection and sensor location are important issues for location performance. A number of experimental data sets representing various damage configurations were compiled using the ten bay truss. The experimental data and the corresponding finite element analysis models are available to researchers for verification of various methods of structure identification and damage location. Author

N91-27579# Army Armament Research, Development and Engineering Center, Watervliet, NY.
CORRELATION BETWEEN MACHINE TWIST ANGLE AND UNIT TWIST ANGLE IN CALCULATING SHEAR STRESSES FOR ELASTIC AND PLASTIC STRAINS IN TORSION Final Report
Robert F. Fujczak Apr. 1991 24 p
(AD-A235729; ARCCB-TR-91013) Avail: NTIS HC/MF A03 CSCL 20/11

For a solid torsion bar, the ratio between the unit twist angle and the machine twist angle remains linear, even when the twist shows plastic deformation. Therefore, the torsional stresses may be calculated from a torque-twist curve, whether the twist axis is unit twist angle or machine twist angle. This allows for stress calculations beyond the limit of the unit twist gage. GRA

N91-27580# Tennessee Univ., Knoxville.
METHODOLOGY FOR PREDICTING DUCTILE INSTABILITY IN WELDED STRUCTURES Final Report
John D. Landes Mar. 1991 183 p
(Contract N00167-89-WR-90210)
(AD-A235999; DTRC/SME-CR-05/91) Avail: NTIS HC/MF A09 CSCL 11/6

The objective of this study was to develop a simple methodology for predicting ductile crack instability in welded structures. The methodology as developed in this project can take the load versus displacement result from a laboratory specimen test and predict the load versus displacement for a structural component. From this, the instability point can be predicted. The ductile methodology developed here was based on the principle of load separation in which two inputs are needed, calibration functions and fracture toughness. The calibration functions can be developed for each structural geometry either numerically by using finite element analysis or empirically by using blunt notched calibration specimens. A number of numerical solutions exist in a G. E. EPRI Handbook. A proper technique for using this Handbook with the methodology was developed in the project. GRA

N91-27581# Applied Research Lab., State College, PA.
MULTICHANNEL ADAPTIVE VIBRATION CONTROL OF A MOUNTED PLATE
L. B. Bishoff and S. D. Sommerfeldt May 1991 100 p
(Contract N00039-88-C-0051)
(AD-A236106; PSU/ARL-TR-91-005) Avail: NTIS HC/MF A05 CSCL 20/11

The possibility is investigated of actively controlling a plate, mounted to a rigid foundation with springs. A multichannel adaptive control system, based on the least mean squares (LMS) algorithm, was developed and applied to the transmission paths of this mechanical plate system. Experimental results are presented for the case of single and multiple frequency excitation. Feedback compensation is developed to remove any feedback in the control system, and thus avoid any instabilities caused by such feedback. The effect of this control on vibrating modal patterns is presented and thus gives insight to global as well as to localized effects of active control. It is shown that this multichannel adaptive control system presents an excellent means of controlling low frequency vibration transmission where passive techniques fail. The issue of stability of a coupled system, such as a plate, is addressed and a solution is presented. In addition, stability and convergence properties of multiadaptive processes are presented. The result is that convergence parameters of each separate adaptive process have to be carefully selected, with respect to other convergence parameters, in order to avoid system instabilities. GRA

N91-27582# California Inst. of Tech., Pasadena.
WAVE PROPAGATION IN LINEAR, BILINEAR AND TRILINEAR ELASTIC BARS
Rohan Abeyaratne and James K. Knowles Apr. 1991 35 p
(Contract N00014-90-J-1871)
(AD-A236199; TR-3) Avail: NTIS HC/MF A03 CSCL 20/11

The role of supplementary conditions such as the entropy inequality at shock waves or kinetic relations is examined at phase boundaries in the selection of physically appropriate solutions to systems of quasi-linear differential equations describing wave propagation. The differences in this respect among various materials are illustrated by contrasting the behavior of waves in linear, bilinear, and trilinear bars. GRA

N91-27583# Brown Univ., Providence, RI. Div. of Engineering.
PART 1: MECHANICS OF THIN FILMS. PART 2: FRACTURE RE OF SOLIDS Final Technical Report
R. Barsoum and L. B. Freund 28 May 1991 8 p
(Contract N00014-87-K-0481)
(AD-A236209) Avail: NTIS HC/MF A02 CSCL 20/11

During the course of this project, research was pursued along two distinct paths. The larger thrust has focused on issues in the fabrication and processing of thin film materials for application in microelectronics, mainly the mechanics of defects in semiconductor materials. A second thrust has focussed on the fracture of structure materials. Results to date are briefly discussed. Author

N91-27584# Washington State Univ., Pullman. Dept. of Physics.
PARTICLE EMISSION AND CHARGING EFFECTS INDUCED BY FRACTURE Technical Report, 1 Jun. 1989 - 30 May 1991
J. T. Dickinson 20 May 1991 242 p
(Contract N00014-87-K-0514)
(AD-A236213; FRACTO-91) Avail: NTIS HC/MF A11 CSCL 20/11

We report on three research areas that have been based on our capabilities to: (1) detect and characterize particle release from surfaces on fast time scales, and (2) to obtain high resolution topographical information utilizing scanning tunneling and atomic force microscopy. The three areas of study have been fracto-emissions, scanning tunneling microscopy studies of fracture surfaces of crystals and polymers, and UV laser interactions with surfaces. These studies have focused on the examination of the energetic processes accompanying fracture, particularly those involving heat generating mechanisms such as dislocation motion and plastic deformation, phenomena at interfaces (often involving charge transfer processes), and high energy UV lasers interacting with inorganic and organic materials. A novel study of the interaction of 248 nm excimer laser radiation with single crystal RDX is included. GRA

N91-27585# Dayton Univ., OH.
STRENGTH ANALYSIS AND DESIGN OF MULTILAYERED THICK COMPOSITE SPHERICAL PRESSURE VESSELS Final Report, May - Aug. 1990
Ajit K. Roy Mar. 1991 45 p
(Contract F33615-87-C-5239)
(AD-A236266; UDR-TR-90-128; WRDC-TR-90-4141) Avail: NTIS HC/MF A03 CSCL 13/4

A design study of a multilayered spherical composite pressure vessel is presented. Each layer of the vessel is composed of quasi-isotropic layups of composite plies. For the stress analysis, however, each layer is assumed to be homogeneous whose three dimensional properties are equivalent to that of the quasi-isotropic plies. The linear theory of elasticity is employed so that the analysis is not limited to any thickness of the vessel. For the strength analysis the Tsai-Wu failure criterion is used. Using the ply constitutive law and lamination angle, the ply stresses and strains are determined from the layer stress strain relations. Then the failure criterion is used for each ply. The objective of this study is to design a spherical vessel with an acceptable safety factor to operate at an internal pressure of 200 MPa. In view of the winding and manufacturing difficulties, a design restriction of b/a less than or equal to 1.25 was set for this design. However a two-layered hybrid sphere of b/a = 1.25 (b: outer radius, a: inner radius) with T300/5208 and IM6/epoxy outside is considered to be an acceptable design. GRA

N91-27586# Purdue Univ., West Lafayette, IN. School of Mechanical Engineering.
VIBRATION DYNAMICS AND CONTROL OF BLADED DISK ASSEMBLIES Final Report, 1 Nov. 1988 - 31 Dec. 1990
O. D. Nwokah and A. K. Bajaj 28 Mar. 1991 132 p
(Grant AF-AFOSR-0014-89; AF Proj. 2302)
(AD-A236287; AFOSR-91-0529TR) Avail: NTIS HC/MF A07 CSCL 01/1

The problems associated with uneven forced response vibration amplitudes in bladed disk assemblies is considered in the report. It is established that uneven vibration amplitudes arise principally by the destruction of cyclic-symmetry by some small perturbations usually within the component manufacturing tolerances. Such perturbations first split some of the eigenvalue degeneracies inherent in all cyclic systems. This split in turn gives rise to the modal bifurcation phenomenon. Particular forms of the modal phenomenon give rise to the uneven vibration amplitudes and under some restricted conditions to the mode localization phenomenon. In this report, group theory, singularity theory and singular perturbation theory are combined to give a complete analysis of uneven amplitudes and mode localization; as a prelude to blade vibration control. GRA

N91-27587# California Inst. of Tech., Pasadena. Div. of Engineering and Applied Science.
LINEAR STABILITY OF A TWO-PHASE PROCESS INVOLVING A STEADILY PROPAGATING PLANAR PHASE BOUNDARY IN A SOLID. PART 1: PURELY MECHANICAL CASE
Eliot Fried Apr. 1991 63 p
(Contract N00014-90-J-1871)
(AD-A236502; TR-4-Pt-1) Avail: NTIS HC/MF A04 CSCL 20/11

The linear stability is studied of an antiplane shear motion which involves a planar phase boundary in an arbitrary element of a wide class of nonelliptic generalized neo-Hookean materials which have two distinct elliptic phases. It is shown, via a normal mode analysis, that, in the absence of inertial effects, such a process is linearly unstable with respect to a large class of disturbances if and only if the kinetic response function (a constitutively supplied entity which gives the normal velocity of a phase boundary in terms of the driving traction which acts on it

or vice versa) is locally decreasing as a function of the appropriate argument. An alternate analysis, in which the linear stability problem is recast as a functional equation for the interface position, allows the interface to be tracked subsequent to perturbation. A particular choice of the initial disturbance is used to show that, in the case of an unstable response, the morphological character of the phase boundary evolves to qualitatively resemble the plate-like structures which are found in displacive solid-solid phase transformations. In the presence of inertial effects a combination of normal mode and energy analyses are used to show that the condition which is necessary and sufficient for instability with respect to the relevant class of perturbations in the absence of inertia remains necessary for the entire class of perturbations and sufficient for all but a very special, and physically unrealistic, subclass of these perturbations. GRA

N91-27588# California Inst. of Tech., Pasadena. Engineering and Applied Science Div.
LINEAR STABILITY OF A TWO-PHASE PROCESS INVOLVING A STEADILY PROPAGATING PLANAR PHASE BOUNDARY IN A SOLID. PART 2: THERMOMECHANICAL CASE
Eliot Fried Apr. 1991 62 p
(Contract N00014-90-J-1871)
(AD-A236541; TR-5-Pt-2) Avail: NTIS HC/MF A04 CSCL 20/11

This investigation is directed toward understanding the role of coupled mechanical and thermal effects in the linear stability of an isothermal antiplane shear motion which involves a single planar phase boundary in a non-elliptic thermoelastic material which has multiple elliptic phases. When the relevant process is static (so that the phase boundary does not move prior to the imposition of the disturbance) it is shown to be linearly stable. However, when the process involves a steadily propagating phase boundary it may be linearly unstable. Various conditions sufficient to guarantee the linear instability of the process are obtained. These conditions depend on the monotonicity of the kinetic response function (a constitutive; supplied entity which relates the driving traction acting on a phase boundary to the local absolute temperature and the normal velocity of the phase boundary) and, in certain cases, on the spectrum of wave-numbers associated with the perturbation to which the process is subjected. Inertia is found to play an insignificant role in the qualitative features of the aforementioned sufficient conditions. It is shown that instability can arise even when the normal velocity of the phase boundary is an increasing function of the driving traction if the temperature dependence in the kinetic response function is of a suitable nature. Significantly, the instability which is present in this setting occurs only in the long waves of the Fourier decomposition of the moving phase boundary, implying that the interface prefers to be highly wrinkled. GRA

N91-27589# California Inst. of Tech., Pasadena.
THE STRUCTURE OF THE NEAR TIP FIELD DURING TRANSIENT ELASTODYNAMIC CRACK GROWTH
L. B. Freund and A. J. Rosakis Apr. 1991 33 p
(Contract N00014-90-J-4051)
(AD-A236889) Avail: NTIS HC/MF A03 CSCL 20/11

The process of dynamic crack growth in a nominally elastic material under conditions of plane strain or plane stress is considered. Of particular concern is the influence of the transient nature of the process on the stress field in the immediate vicinity of the crack tip during nonsteady growth. Asymptotically, the crack tip stress field is square root singular at the crack tip, with the angular variation of the singular field depending weakly on the instantaneous crack tip speed and with the instantaneous stress intensity factor being a scalar multiplier of the singular field. However, for a material practice at a small distance from the moving crack, the local stress field depends not only on instantaneous values of crack speed, stresses and stress intensity factor, but also on the past history of these time-dependent quantities. Within some small region near the tip, the two dimensional elastic field must give way to region of inelastic deformation. If this inelastic zone is completely surrounded by a stress intensity factor field, then it is assumed that fracture will begin when the value of stress intensity factor has been increased to a material specific value, the fracture toughness of the material. When the stress intensity factor idea is applied to the case of a through the thickness cracking of plates, the restrictions become more severe if the process is associated with a two dimensional state of plane stress. GRA

N91-27590# Kozin Bogdanoff and Associates, Inc., West Lafayette, IN.
REACTION RATE ENGINEERING MODELS OF FATIGUE CRACK GROWTH Final Report
F. Kozin and J. L. Bogdanoff 15 Apr. 1991 91 p
(Contract F49620-90-C-0059)
(AD-A236975; AFOSR-91-0514TR) Avail: NTIS HC/MF A05 CSCL 20/11

A macro model is presented of fatigue cracks growth (FCG) in a thin center crack panel of polycrystalline ductile metal subject to an axial periodically varying tensile load. The macro model is based upon a fundamental micro result from reaction rate theory. The deterministic version of this model applies to the mean time to reach a given crack length. Variability is introduced at the macro level to produce a probabilistic version. The parameters of this physically based model are directly related to the physical properties of the material, the temperature T, and the load. The form of the periodic load and T are important quantities in predicting crack growth. Analysis of FCG data for periodically varying loads reveals that three material parameters are required. The minimum amount testing required for predictive purposes is also discussed as is an interesting method for accelerating tests. Because of the physical basis of the model, it provides new insight into the FCG process. GRA

N91-27591*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, OH.
AEROELASTIC MODAL CHARACTERISTICS OF MISTUNED BLADE ASSEMBLIES: MODE LOCALIZATION AND LOSS OF EIGENSTRUCTURE
Christophe Pierre and Durbha V. Murthy (Toledo Univ., OH.) Jul. 1991 38 p Previously announced as A91-32032
(Grants NAG3-1163; NAG3-742; NASA Order C-99066-G)
(NASA-TM-104519; E-6389; NAS 1.15:104519; ICOMP-91-12)
Avail: NTIS HC/MF A03 CSCL 20K

An investigation of the effects of small mistuning on the aeroelastic modes of bladed disk assemblies with aerodynamic coupling between blades is presented. The cornerstone of the approach is the use and development of perturbation methods that exhibit the crucial role of the interblade coupling and yield general findings regarding mistuning effects. It is shown that blade assemblies with weak aerodynamic interblade coupling are highly sensitive to small blade mistuning, and that their dynamics is quantitatively altered in the following ways: the regular pattern that characterizes the root locus of the tuned aeroelastic eigenvalues in the complex plane is totally lost; the aeroelastic mode shapes becomes severely localized to only a few blades of the assembly and lose their constant interblade phase angle feature; and curve veering phenomena take place when the eigenvalues are plotted versus a mistuning parameter. Author

N91-27592*# National Aeronautics and Space Administration. Hugh L. Dryden Flight Research Facility, Edwards, CA.
COMPRESSIVE BUCKLING ANALYSIS OF HAT-STIFFENED PANEL
William L. Ko and Raymond H. Jackson Washington Aug. 1991 16 p
(NASA-TM-4310; H-1724; NAS 1.15:4310) Avail: NTIS HC/MF A03 CSCL 20K

Buckling analysis was performed on a hat-stiffened panel subjected to uniaxial compression. Both local buckling and global buckling were analyzed. It was found that the global buckling load was several times higher than the buckling load. The predicted local buckling loads compared favorably with both experimental data and finite-element analysis. Author

N91-27593# Technische Hogeschool, Delft (Netherlands).
CRYOGENIC BOND STRESS-SLIP RELATIONSHIP
C. Veen 1991 120 p Sponsored by Stichting voor de Technische Wetenschappen, Utrecht (Netherlands)
(PB91-180943) Avail: NTIS HC/MF A06 CSCL 20K

The classical bond-slip theory used to determine the most important parameters which affect crack width and spacing. The theory assumes that, when the tensile capacity of the concrete is reached, the concrete cracks. At room temperature it is common practice to assume a linear relation between the bond stress and the compressive strength. To verify this relationship at low temperatures, the compressive strength of concrete is also investigated. Thus the aim herein is to determine at least the bond stress-slip relationship, the tensile (splitting) strength, the compressive strength and the thermal behavior of the concrete at various temperatures. The classical bond-slip theory is also expected to be valid at low temperatures, which should be proven analytically and experimentally. Much attention is paid to the modelling of the splitting failure mechanism as a function of temperature. In practice this failure mode should be prevented because failure takes place in a brittle way. GRA

N91-27594# California Univ., Berkeley. Dept. of Civil Engineering.
EXPERIMENTAL STUDY OF FLAT-PLATE STRUCTURES UNDER VERTICAL AND LATERAL LOADS
S. J. Hwang and J. P. Moehle Jul. 1990 281 p
(PB91-164350; UCB/SEMM-90/11) Avail: NTIS HC/MF A13 CSCL 20K

A reinforced concrete flat-plate structure was built at four-tenths of full scale and tested at the Structural Laboratory of the University of California at Berkeley. The test structure modeled a prototype structure having three bays in each direction. The floor slab was supported o columns without beams, drop panels, or slab shear reinforcement. Proportions of the structure were determined according to conventional design and practice. Details satisfied requirements of the ACI 318-83 Code. Some redistributions of negative moments for connections were taken. Gravity load tests were conducted to observe structural responses at the service load level. Lateral load tests were conducted to monitor service load behavior as well as ultimate capacities. Post failure behavior was also investigated. The report documents the experiments, presents measured data and observations, and describes analytical methods and results. Analytical studies include methods to model the vertical and lateral load stiffnesses including cracking due to service loads, and models to estimate the strength of the connections. GRA

N91-27595# National Inst. of Standards and Technology, Gaithersburg, MD. Mechanical Properties and Performance Div.
INTERCOMPARISON STUDY OF ROCKWELL HARDNESS TEST BLOCKS
T. Robert Shives and John H. Smith Feb. 1991 74 p
(PB91-167338; NISTIR-4531) Avail: NTIS HC/MF A04 CSCL 20K

The National Institute of Standards and Technology undertook an intercomparison study of Rockwell hardness test blocks marketed in the United States. Test blocks from six different manufacturers were included in the study. Measurements were made generally on seven sets of test blocks at three hardness levels for each of the HRC, HRB, HR30N, and HR30T hardness scales. Even for the early ideal conditions of study, it was found that there are significant differences among hardness test blocks of different manufacturers for some hardness levels. This is especially true for the high hardness part of the HRC scale, the lower and middle parts of the HRB scale, and parts of both the HR30N and HR30T scales. In these regions, the ranges of test results for blocks of different manufacturers that have similar assigned values exceed the tolerance limits for standardized test blocks according to ASTM Standard E 18-89a. Reevaluation of HRB and HR30T test blocks four of five years after initial evaluation indicated that many of these are unstable. There were significant changes in hardness in a number of the blocks. GRA

N91-27596# National Inst. of Standards and Technology, Gaithersburg, MD. Metallurgy Div.
CRACK ARREST FRACTURE TOUGHNESS MEASUREMENTS OF NORMALIZED AND INCLUSION SHAPE CONTROLLED AAR-TC128 GRADE B STEEL, AND MICRO-ALLOYED, CONTROL-ROLLED, AND INCLUSION SHAPE CONTROLLED A 8XX GRADE B STEEL
G. E. Hicho Feb. 1991 18 p
(PB91-167346; NISTIR-4501; Rept-21) Avail: NTIS HC/MF A03 CSCL 20K

The crack arrest fracture toughness was determined for normalized AAR TC 128 grade B steel and control rolled A 8XX grade B steel. Both steels were made using inclusion shape control practice. The crack arrest fracture toughness of the AAR TC 128 steel was slightly better than that for the A 8XX steel. Author

42 GEOSCIENCES (GENERAL)

N91-27597*# Pennsylvania State Univ., University Park. Dept. of Geography.
AN ASSESSMENT OF NASA MASTER DIRECTORY/CATALOG INTEROPERABILITY FOR INTERDISCIPLINARY STUDY OF THE GLOBAL WATER CYCLE Final Report
Donna J. Peuquet 1 May 1991 37 p
(Grant NAG5-1437)
(NASA-CR-185992; NAS 1.26:185992) Avail: NTIS HC/MF A03 CSCL 04A

The most important issue facing science is understanding global change; the causes, the processes involved and their consequences. The key to success in this massive Earth science research effort will depend on efficient identification and access to the most data available across the atmospheric, oceanographic, and land sciences. Current mechanisms used by earth scientists for accessing these data fall far short of meeting this need. Scientists must as a result frequently rely on a priori knowledge and informal person to person networks to find relevant data. The Master Directory/Catalog Interoperability Program (MC/CI) undertaken by NASA is an important step in overcoming these problems. The stated goal of the MD project is to enable researchers to efficiently identify, locate, and obtain access to space and Earth science data. For individual titles, see N91-27598 through N91-27600.

N91-27598*# Pennsylvania State Univ., University Park.
ICE-ATMOSPHERE INTERACTIONS IN THE POLAR OCEANS **c46**
Robert Crane *In its* An Assessment of NASA Master Directory/Catalog Interoperability for Interdisciplinary Study of the Global Water Cycle 1 May 1991 p 5-9 (For primary document see N91-27597 19-42)
Avail: NTIS HC/MF A03 CSCL 04A

Sea ice forms a major reservoir in the global water cycle and both polar regions undergo a large seasonal variation in their sea ice cover. The extent of this sea ice cover is a function of both dynamic and thermodynamic interactions with the atmosphere and ocean. These sea ice atmospheric interactions are examined in terms of the atmospheric controls on ice cover, and the resulting feedbacks to the climate system. The role of sea ice in global climate change is determined. The relationship between sea ice and the synoptic scale atmospheric circulation in the North Atlantic is examined. This region is chosen for more detailed study because the project involves land ice and there is a focus on Greenland and because there have been several previous international field programs in the region and more are planned. Author

N91-27599*# Pennsylvania State Univ., University Park.
DETERMINATION AND IMPACT OF SURFACE RADIATIVE PROCESSES FOR TOGA COARE **c46**
Judith A. Curry, Thomas Ackerman, William B. Rossow, and Peter J. Webster *In its* An Assessment of NASA Master

Directory/Catalog Interoperability for Interdisciplinary Study of the Global Water Cycle 1 May 1991 p 10-21 (For primary document see N91-27597 19-42)
Avail: NTIS HC/MF A03 CSCL 04A

Experiments using atmospheric general circulation models have shown that the atmospheric circulation is very sensitive to small changes in sea surface temperature in the tropical western Pacific Ocean warm pool region. The mutual sensitivity of the ocean and the atmosphere in the warm pool region places stringent requirements on models of the coupled ocean atmosphere system. At present, the situation is such that diagnostic studies using available data sets have been unable to balance the surface energy budget in the warm pool region to better than 50 to 80 W/sq m. The Tropical Ocean Global Atmosphere (TOGA) Coupled Ocean Atmosphere Response Experiment (COARE) is an observation and modelling program that aims specifically at the elucidation of the physical process which determine the mean and transient state of the warm pool region and the manner in which the warm pool interacts with the global ocean and atmosphere. This project focuses on one very important aspect of the ocean atmosphere interface component of TOGA COARE, namely the temporal and spatial variability of surface radiative fluxes in the warm pool region. Author

N91-27600*# Pennsylvania State Univ., University Park.
CLIMATE AND SOCIETY IN 20TH CENTURY MEXICO c47
Diana M. Liverman *In its* An Assessment of NASA Master Directory/Catalog Interoperability for Interdisciplinary Study of the Global Water Cycle 1 May 1991 p 22-31 (For primary document see N91-27597 19-42)
Avail: NTIS HC/MF A03 CSCL 04B

Mexican agriculture has been greatly transformed by the widespread introduction of 'Green Revolution' technologies (irrigation, chemical fertilizers, and improved seeds), through land reform, and by land use policies oriented to export crops and grain production. Drought prone Mexico provides an excellent case to study how technological and social changes alter the impact of drought on food and agricultural system. A goal is to document and understand how relationships between climate and agriculture in Mexico have changed in the last fifty years. The results for several locations will be interpreted in light of the prospects of regional climate change due to global warming. This analysis will be complimented by four case studies of vulnerability to drought which will use local records and interviews to try and show how environmental, technological, and social changes may have altered the impacts of climate on local agricultural systems. Author

N91-27601*# New Hampshire Univ., Durham.
ISY MISSION TO PLANET EARTH CONFERENCE: A PLANNING MEETING FOR THE INTERNATIONAL SPACE YEAR
Harvey Meyerson 1991 42 p Conference held in Durham, NH, 29 Apr. - 1 May 1988 Sponsored by NASA, Washington
(NASA-CR-188225; NAS 1.26:188225) Avail: NTIS HC/MF A03 CSCL 08B

A major theme was the opportunity offered by the International Space Year (ISY) to initiate a long-term program of Earth observation mission coordination and worldwide data standardization. The challenge is immense and extremely time critical. A recommendation was made to inventory the capabilities of Earth observing spacecraft scheduled during the next decade. The ISY effort to strengthen coordination and standardization should emphasize global issues, and also regional initiatives of particular relevance to developing nations. The concepts of a Global Information System Test (GIST) was accepted and applied to specific issues of immediate concern. The importance of ISY Earth observation initiatives extending beyond research to include immediate and direct applications for social and economic development was stressed. Several specific Mission to Planet Earth proposals were developed during the Conference. A mechanism was set up for coordinating participation of the national space agencies or equivalent bodies. B.G.

N91-27602# Joint Publications Research Service, Arlington, VA.
JPRS REPORT: SCIENCE AND TECHNOLOGY. USSR: EARTH SCIENCES
23 May 1991 35 p Transl. into ENGLISH from various Russian articles
(JPRS-UES-91-004) Avail: NTIS HC/MF A03

Abstracts on U.S.S.R. research in Earth sciences are given. Topics covered include Arctic and Antarctic research, geology, meteorology, oceanography, atmospheric physics, and ecology. Author

43 EARTH RESOURCES AND REMOTE SENSING

Includes remote sensing of earth resources by aircraft and spacecraft; photogrammetry; and aerial photography.

For instrumentation see *35 Instrumentation and Photography.*

N91-27603*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, MD.
THE 1991 EOS REFERENCE HANDBOOK
David Dokken, ed. May 1991 146 p
(NASA-NP-144; NAS 1.83:144) Avail: NTIS HC/MF A07 CSCL 08B

The following topics are covered: (1) The Global Change Research Program; (2) The Earth Observing System (EOS) goal and objectives; (3) primary EOS mission requirements; (4) EOS science; (5) EOS Data and Information System (EOSDIS) architecture; (6) data policy; (7) international cooperation; (8) plans and status; (9) the role of the National Oceanic and Atmospheric Administration; (10) The Global Fellowship Program; (11) management of EOS; (12) mission elements; (13) EOS instruments; (14) interdisciplinary science investigations; (15) points of contact; and (16) acronyms and abbreviations. K.S.

N91-27604*# Massachusetts Inst. of Tech., Cambridge. Research Lab. of Electronics.
REMOTE SENSING OF EARTH TERRAIN Progress Report, 1 Jan. - 30 Jun. 1991
Jin Au Kong, Herng-Aung Yueh, and Robert T. Shin 1991 28 p
(Grant NAGw-1617)
(NASA-CR-188658; NAS 1.26:188658) Avail: NTIS HC/MF A03 CSCL 08B

Abstracts from 46 refereed journal and conference papers are presented for research on remote sensing of earth terrain. The topics covered related to remote sensing include the following: mathematical models, vegetation cover, sea ice, finite difference theory, electromagnetic waves, polarimetry, neural networks, random media, synthetic aperture radar, electromagnetic bias, and others. K.S.

N91-27605# Nova Univ., Dania, FL. Oceanographic Center.
GENERALIZED LATITUDE AND LONGITUDE IN A GENERAL RIEMANNIAN SPACE, WITH A SPECIALIZATION FOR HOTINE'S (OMEGA, PHI, NU) COORDINATE SYSTEM
Georges Blaha Feb. 1991 87 p
(Contract F19628-89-K-0016)
(AD-A235584; PL-TR-91-2053; SR-2) Avail: NTIS HC/MF A05 CSCL 08/2

The present study seeks to find out whether Hotine's coordinate system (omega, phi, N) could be admissible in a class of general (curved) Riemannian spaces. The adopted approach postulates generalized quantities omega and phi to be coordinates and then examines, via commutators, in what kind of space this may hold true; the third coordinate remains N, a differentiable scalar function of position, which is assumed to be admissible in any space. The commutators lead to six conditions for six independent components of the covariant Riemann-Christoffel tensor. In the case of the original Hotine's coordinates omega and phi, it is shown that these components are identically zero, and, therefore, that the space

must be flat. This implies that all orders of covariant derivatives of A sub r, B sub r, C sub r must be zero, where the orthonormal triad A, B, C represents Hotine's base vectors. Besides disproving the admissibility of the (omega, phi, N) coordinate system in any but the flat space, the analysis cross validates a number of equations from Zund, 1990, applicable to the flat space, and presents several new relations that do not have equivalents in Hotine, 1969 or Zund, 1990. GRA

N91-27606# Naval Research Lab., Washington, DC.
A SIMPLE TECHNIQUE FOR DISPLAYING WDB-2 DIGITAL CARTOGRAPHIC IMAGERY IN KEE Memorandum Report
James A. Kilgore, Jr. 7 May 1991 33 p
(AD-A235800; NRL-MR-6797) Avail: NTIS HC/MF A03 CSCL 12/7

A technique for displaying World Data Bank II digital cartographic imagery in KEE using Keepictures is described. World Data Bank II is a cartographic database of the world distributed by the Central Intelligence Agency and divides the world into five geographic areas that are represented by unique line segments defined by individually digitized points. Keepictures is a computer graphics toolkit that is a part of the Knowledge Engineering Environment (KEE) which is a commercial software development product by Intellicorp, Inc. GRA

N91-27607# Naval Oceanographic and Atmospheric Research Lab., Bay Saint Louis, MS.
NEONS ENVIRONMENTAL DATABASE: RECENT DEVELOPMENTS
Andrew Jurkevics, Richard Titus, and Ted Tsui Jan. 1991 5 p Presented at the 7th International Conference on Interactive Information and Processing Systems for Meteorology, Oceanography, and Hydrology, New Orleans, LA, 14-18 Jan. 1991
(AD-A236477; AD-E040008; NOARL-PR-91-003-431) Avail: NTIS HC/MF A01 CSCL 04/2

The Naval Environmental Operational Nowcasting System (NEONS) is being developed at the Naval Oceanographic and Atmospheric Research Laboratory (NOARL) to support research into new techniques for analysis and interpretation of environmental data. A primary objective of the workstation system is to facilitate the virtual sensor concept, whereby data from a variety of sources are integrated and blended to extract information about the environment not possible using any single sensor. When these virtual sensor techniques are developed, they will be implemented on the Naval Tactical Environment Support System (TESS(3)). One component of NEONS is an environmental database which provides storage, management, and access to a large variety of oceanographic and atmospheric data. An introduction to NEONS and its database was presented. Further developments in the database component of NEONS within the past 12 months are described. GRA

N91-27608# Naval Observatory, Washington, DC.
ON HIGH FREQUENCY SPECTRAL ANALYSIS OF VERY NOISY STOCHASTIC PROCESSES AND ITS APPLICATION TO ERP SERIES DETERMINED BY VLBI AND SLR
Wieslaw Kosek 15 Feb. 1991 24 p
(AD-A236987; NOBS-CIRC-177) Avail: NTIS HC/MF A03 CSCL 08/5

Increased accuracy of measurement techniques in geodesy allows the investigation of weak short periodic variations in Earth Rotation Parameters (ERP). These variations in the ERP of a short periodic nature from 10 to 100 days are of the order of the measurement error or smaller. Therefore, application of an optimum method of spectral analysis is very important. In order to determine the best spectral analysis to find short period oscillations in real geophysical data, the following spectral analysis methods have been used to compute the frequencies in simulated data: (1) Fast Fourier Transformation (FFT); (2) Blackman-Tuckey spectral analysis; (3) Maximum Entropy Spectral Analysis (MESA); and (4) Band Pass Filter Spectral Analysis (BPFSA). GRA

N91-27609# National Oceanic and Atmospheric Administration, Boulder, CO. Wave Propagation Lab.
OPTICAL REMOTE SENSING
L. M. Kovacs and J. H. Churnside Feb. 1991 89 p Prepared in cooperation with Colorado Univ., Boulder
(PB91-169755; NOAA-TM-ERL-WPL-191) Avail: NTIS HC/MF A05 CSCL 08B

The random absorption and refraction experienced by the electromagnetic wave produced fluctuations in the wave amplitude and phase as observed at a remote point. The impact of these fluctuations on a double-spatial filtering receiver is evaluated by performing a diffraction analysis on the system. The diffraction analysis covers a complete study of an electromagnetic wave field at the focal plane. The transmitter can be any natural or artificial source. The choice in the configuration is the sun. Theoretically, the technique provides high spatial resolution measurements of wind velocity and turbulence. GRA

N91-27610*# Oregon State Univ., Corvallis. Dept. of Bioresource Engineering.
USING LANDSAT TO PROVIDE POTATO PRODUCTION ESTIMATES TO COLUMBIA BASIN FARMERS AND PROCESSORS Project Summary
1990 44 p
(Contract NCC2-569)
(NASA-CR-188686; NAS 1.26:188686) Avail: NTIS HC/MF A03 CSCL 02C

A summary of project activities relative to the estimation of potato yields in the Columbia Basin is given. Oregon State University is using a two-pronged approach to yield estimation, one using simulation models and the other using purely empirical models. The simulation modeling approach has used satellite observations to determine key dates in the development of the crop for each field identified as potatoes. In particular, these include planting dates, emergence dates, and harvest dates. These critical dates are fed into simulation models of crop growth and development to derive yield forecasts. Two empirical modeling approaches are illustrated. One relates tuber yield to estimates of cumulative intercepted solar radiation; the other relates tuber yield to the integral under the GVI curve. Author

N91-27680# Bureau of Mineral Resources, Geology and Geophysics, Canberra (Australia).
REMOTE SENSING OF NATURAL HYDROCARBON SEEPAGE AT THE PALM VALLEY GAS FIELD, AMADEUS BASIN, CENTRAL AUSTRALIA
C. J. Simpson, J. R. Wilford, L. F. Macias, and Russell J. Korsch *In its* Geological and Geophysical Studies in the Amadeus Basin, Central Australia, Bulletin 236 1991 p 541-561 Original contains color illustrations (For primary document see N91-27647 19-46)
Avail: Issuing Activity; 15 functional color pages

N91-27681# Lau (G. C. and J. E.) and Associates, Canberra (Australia).
AQUIFER CHARACTERISTICS AND GROUNDWATER RESOURCES OF THE AMADEUS BASIN
J. E. Lau and G. Jacobson (Bureau of Mineral Resources, Geology and Geophysics, Canberra, Australia) *In* Bureau of Mineral Resources, Geology and Geophysic Geological and Geophysical Studies in the Amadeus Basin, Central Australia, Bulletin 236 1991 p 563-579 Sponsored in part by Department of Primary Industries and Energy (For primary document see N91-27647 19-46)
Avail: Issuing Activity; 15 functional color pages

44 ENERGY PRODUCTION AND CONVERSION

Includes specific energy conversion systems, e.g., fuel cells; global sources of energy; geophysical conversion; and windpower.

For related information see also *07 Aircraft Propulsion and Power, 20 Spacecraft Propulsion and Power,* and *28 Propellants and Fuels.*

N91-27611*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, OH.
PRELIMINARY DESIGN OF A MOBILE LUNAR POWER SUPPLY
Paul C. Schmitz, Barbara H. Kenny, and Christopher R. Fulmer (General Dynamics Corp., San Diego, CA.) 1991 13 p Presented at the 26th Intersociety Energy Conversion Engineering Conference, Boston, MA, 4-9 Aug. 1991; sponsored by ANS, SAE, ACS, AIAA, ASME, IEEE, and AIChe
(NASA-TM-104471; E-6376; NAS 1.15:104471) Avail: NTIS HC/MF A03 CSCL 10B

A preliminary design for a Stirling isotope power system for use as a mobile lunar power supply is presented. Performance and mass of the components required for the system are estimated. These estimates are based on power requirements and the operating environment. Optimizations routines are used to determine minimum mass operational points. Shielding for the isotope system are given as a function of the allowed dose, distance from the source, and the time spent near the source. The technologies used in the power conversion and radiator systems are taken from ongoing research in the Civil Space Technology Initiative (CSTI) program. Author

N91-27612# National Academy of Sciences - National Research Council, Washington, DC.
ASSESSMENT OF RESEARCH NEEDS FOR WIND TURBINE ROTOR MATERIALS TECHNOLOGY
Kamal J. Araj, Theresa A. Fisher, and Jan C. Kronenburg 1991 115 p
(Contract DE-AC04-89AL-58181)
(NAT-S-324; LC-91-60990; ISBN-0-309-04479-0) Avail: NTIS HC/MF A06

Wind-driven power systems represent a renewable technology that is still in the early stages of its development and maturation. It is a renewable power technology that, during the course of its rapid evolution over the last decade, has accumulated significant, large-scale, utility-connected experience. The focus is on the need for improved knowledge of materials properties and advanced, economical, high volume manufacturing processes. The first chapter: (1) traces the evolution of wind power systems in the United States; (2) identifies the principle components of a power-generating wind turbine; and (3) presents a simplified description of the relationship between the power in the wind and the power flow through the turbine drive train, and describes the characteristics of the wind environment that impact both the short and long term structural integrity of wind turbines. The remaining chapters of this report explore and further define the need for improved materials properties, manufacturing processes, and control systems. Author

N91-27613*# Sverdrup Technology, Inc., Brook Park, OH.
DESIGN, OPTIMIZATION, AND ANALYSIS OF A SELF-DEPLOYING PV TENT ARRAY Final Report
Anthony J. Collozza Jun. 1991 18 p Presented at the 26th Intersociety Energy Conversion Engineering Conferences, Boston, MA, 4-9 Aug. 1991; sponsored by ANS, SAE, ACS, AIAA, ASME, IEEE, and AIChE
(Contract NAS3-25266)
(NASA-CR-187119; E-6252; NAS 1.26:187119) Avail: NTIS HC/MF A03 CSCL 10B

A tent shaped PV array was designed and the design was optimized for maximum specific power. In order to minimize output power variation a tent angle of 60 deg was chosen. Based on the chosen tent angle an array structure was designed. The design considerations were minimal deployment time, high reliability, and small stowage volume. To meet these considerations the array was chosen to be self-deployable, form a compact storage configuration, using a passive pressurized gas deployment mechanism. Each structural component of the design was analyzed to determine the size necessary to withstand the various forces to which it would be subjected. Through this analysis the component weights were determined. An optimization was performed to determine the array dimensions and blanket geometry which produce the maximum specific power for a given PV blanket. This optimization was performed for both lunar and Martian environmental conditions. Other factors such as PV blanket types, structural material, and wind velocity (for Mars array), were varied to determine what influence they had on the design point. The performance specifications for the array at both locations and with each type of PV blanket were determined. These specifications were calculated using the Arimid fiber composite as the structural material. The four PV blanket types considered were silicon, GaAs/Ge, GaAsCLEFT, and amorphous silicon. The specifications used for each blanket represented either present day or near term technology. For both the Moon and Mars the amorphous silicon arrays produced the highest specific power. Author

N91-27614* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, OH.
THIN SOLAR CELL AND LIGHTWEIGHT ARRAY Patent
Henry W. Brandhorst, Jr., inventor (to NASA) and Irving Weinberg, inventor (to NASA) 28 May 1991 14 p Filed 20 Mar. 1990
(NASA-Case-LEW-14959-1; US-Patent-5,019,176; US-Patent-Appl-SN-495969; US-Patent-Class-136-244; US-Patent-Class-136-249; US-Patent-Class-136-256; US-Patent-Class-357-30; US-Patent-Class-437-2; Int-Patent-Class-H01L-31/42; Int-Patent-Class-H01L-31/18)
Avail: US Patent and Trademark Office CSCL 10A

A thin, lightweight solar cell that utilizes front contact metallization is presented. Both the front light receiving surface of the solar cell and the facing surface of the cover glass are recessed to accommodate this metallization. This enables the two surfaces to meet flush for an optimum seal.
Official Gazette of the U.S. Patent and Trademark Office

45 ENVIRONMENT POLLUTION

Includes atmospheric, noise, thermal, and water pollution.

N91-27615# General Accounting Office, Washington, DC.
ENVIRONMENTAL PROTECTION: SOLVING NASA'S CURRENT PROBLEMS REQUIRES AGENCYWIDE EMPHASIS
Apr. 1991 38 p
(GAO/NSIAD-91-146) Avail: NTIS HC/MF A03

A GAO investigation was conducted to determine the extent of environmental problems confronting NASA and the corrective actions being taken or planned. The report assesses NASA's management of its environmental protection program. It is concluded that program office and Facilities Engineering staff need to work together more closely in the development of an agencywide strategy, including center-based, measurable goals, on implementing to effectively monitor the activities of NASA's nine centers. GAO recommends the environmental pollution prevention, abatement, and control policy. Standards should be established on center environmental staff levels and qualifications, organizational authority, and mechanisms developed to identify funding requirements. Criteria and guidelines should be developed for center reporting of noncompliance with environmental regulations and it should be required that problems identified at one center be addressed at other centers with similar facilities or functions. It is also recommended that an environmental audit program be established to evaluate, at least every three years, a center's regulatory compliance and management systems for ensuring such compliance. Author

N91-27616# Pacific Northwest Lab., Richland, WA.
COMPARISON OF MAGIC AND DIATOM PALEOLIMNOLOGICAL MODEL HINDCASTS OF LAKEWATER ACIDIFICATION IN THE ADIRONDACK REGION OF NEW YORK
T. J. Sullivan, J. A. Bernert, J. M. Eliers, E. A. Jenne, and B. J. Cosby (Duke Univ., Durham, NC.) Mar. 1991 127 p
(Contract DE-AC06-76RL-01830)
(DE91-010125; PNL-7487) Avail: NTIS HC/MF A07

Thirty-three lakes that had been statistically selected as part of the U.S. Environmental Protection Agency's Eastern Lake Survey and Direct Delayed Response Project (DDRP) were used to compare the MAGIC (watershed) and Diatom (paleolimnological) models. The study lakes represented a well defined group of Adirondack lakes, each larger than 4 ha in area and having acid-neutralizing capacity (ANC) greater than 400 micro-eq/L. The study first compared current and pre-industrial (before 1850) pH and ANC estimates from Diatom and MAGIC as they were calibrated in the preceding Paleocological Investigation of Recent Lake Acidification (PIRLA) and DDRP studies, respectively. Initially, the comparison of hindcasts of pre-industrial chemistry was confounded by seasonal and methodological differences in lake chemistry data used in calibration of the model. Although certain differences proved to be of little significance for comparison, MAGIC did predict significantly higher pre-industrial ANC and pH values than did Diatom, using calibrations in the preceding studies. Both models suggest acidification of low ANC Adirondack region lakes since preindustrial times, but differ primarily in that MAGIC inferred greater acidification and that acidification has occurred in all lakes in the comparison, whereas Diatom inferred that acidification has been restricted to low ANC lakes (greater than about 50 micro-eq/L). DOE

N91-27617*# National Aeronautics and Space Administration. Goddard Inst. for Space Studies, New York, NY.
VULNERABILITY OF THE US TO FUTURE SEA LEVEL RISE
V. Gornitz, T. W. White, and R. M. Cushman (Oak Ridge National Lab., TN.) 1991 15 p Presented at the 7th Symposium on Coastal and Ocean Management, Long Beach, 8-12 Jul. 1991
(Contract DE-AC05-84OR-21400)
(NASA-TM-105018; NAS 1.15:105018; DE91-007853; CONF-910780-1) Avail: NTIS HC/MF A03 CSCL 13B

The differential vulnerability of the conterminous United States to future sea level rise from greenhouse climate warming is assessed, using a coastal hazards data base. This data contains information on seven variables relating to inundation and erosion risks. High risk shorelines are characterized by low relief, erodible substrate, subsidence, shoreline retreat, and high wave/tide energies. Very high risk shorelines on the Atlantic Coast (Coastal Vulnerability Index is greater than or equal to 33.0) include the outer coast of the Delmarva Peninsula, northern Cape Hatteras, and segments of New Jersey, Georgia and South Carolina. Louisiana and sections of Texas are potentially the most vulnerable, due to anomalously high relative sea level rise and erosion, coupled with low elevation and mobile sediments. Although the Pacific Coast is generally the least vulnerable, because of its rugged relief and erosion-resistant substrate, the high geographic variability leads to several exceptions, such as the San Joaquin-Sacramento Delta area, the barrier beaches of Oregon and Washington, and parts of the Puget Sound Lowlands. DOE

N91-27618# Oak Ridge K-25 Site, TN.
GREENHOUSE WARMING POTENTIAL OF CANDIDATE GASEOUS DIFFUSION PLANT COOLANTS
L. D. Trowbridge Mar. 1991 24 p
(Contract DE-AC05-84OT-21400)
(DE91-009986; K/ETO-50) Avail: NTIS HC/MF A03

A preliminary estimate has been made of the greenhouse warming potential (GWP) of coolants under consideration as substitutes for CFC-114 in the gaseous diffusion plants. Coolants are not at present regulated on the basis of GWP, but may well be in the future. Use of c-C4F8 or n-C4F10 is estimated to have three to four times the greenhouse impact of an equivalent use of CFC-114. Neither of the substitutes, of course, would cause any ozone depletion. HCFC-124 (a probable commercial substitute for CFC-114, but not presently under serious consideration due to its relatively high UF6 reactivity) would have much less greenhouse and ozone depletion impact than CFC-114. The GWP estimates derive from a simple model that approximately reproduces literature values for similar compounds. The major uncertainty in these estimates lies in the atmospheric lifetime, especially of the perfluorocarbon compounds, for which little reliable information exists. In addition to GWP estimates for coolants, the overall greenhouse impact of the gaseous diffusion plants is calculated, including indirect power-related CO2 emissions. This result is used to compare greenhouse impacts of nuclear- and coal-produced electricity. DOE

N91-27619# Institute of Energy Economics of Japan.
GLOBAL WARMING POLICIES IN THE US AND CANADA
1 Dec. 1990 140 p In JAPANESE
(DE91-778707; IEE-SR-216) Avail: NTIS HC/MF A07

The effects of global warming policies in the U.S. and Cananda on their oil policies is examined. The survey covers activities of the government and government offices, the move toward legislation, recent socio-economic researches, and reports effects on policies. In conclusion, the U.S. thinks that they should assume the leadership in international prevention of the global warming, considering that it is better to develop the global warming policy in the following three stages: scientific investigation of global changes, evaluation of effects incidental to policy, policy development, They also think that an international and internal consensus is necessary. The Congress promotes an increase in efficiency of automobiles of machinery. Since most of the oil consumption is directed to the traffic and electric power generating fields, the policy will be an indirect one aiming at reducing consumption of fossil fuel in these fields. On the other hand, Canada obtains 80 pct of their electric power consumption from nuclear energy and water power and intends to conduct CO2 reduction by regulating in the traffic field, in particular, in the automobile field. DOE

N91-27620# Institute of Energy Economics of Japan.
SURVEY OF IMPACTS OF GLOBAL ENVIRONMENTAL ISSUES ON THE UTILIZATIONS OF ALTERNATIVE ENERGIES FOR OIL
31 Dec. 1990 289 p In JAPANESE; ENGLISH summary
(DE91-778709; IEE-SR-218) Avail: NTIS HC/MF A13

This is a report on the global warming issue made by the Institute of Energy Economics entrusted with the survey by NEDO. The following are titles of the chapters presented: (1) outline of global warming problems and developments of international conferences; (2) factor analysis of past CO2 emissions; (3) measures to limit global warming; and (4) limitation measures for global warming and prospects for CO2 emissions. Analyses are made by country, region, or globally. For example, in order to establish measures to solve the global warming problem as an international issue, it is most important to establish the target criteria to control emission of greenhouse gases like CO2. Namely, it is important to determine the criteria and partial charge of each country. These will exert a large effect on each economic activity. There are big differences among countries in the gas emission up to the present from the past. Effects of the gas emission are also different among countries. Moreover, countries are different in their development stages. All these differences are an important subject in judging international fairness. DOE

N91-27621# Army Cold Regions Research and Engineering Lab., Hanover, NH.
SYMPOSIUM ON THE TROPOSPHERIC CHEMISTRY OF THE ANTARCTIC REGION: PRE-CONFERENCE ABSTRACTS
A. Hogan and S. L. Bowen Jun. 1991 74 p
(AD-A236274; CRREL-SR-91-10) Avail: NTIS HC/MF A04 CSCL 03/2

At present, lidar techniques are successfully used to study tropospheric aerosols. Lidar systems help to understand dynamic

processes in the atmosphere. This paper describes the lidar systems used to study the tropospheric aerosols and gas composition of the atmosphere, aerosol and humidity distribution in the atmospheric underlayer over the ocean and experimental measurements of CO2 concentrations. Two wavelengths were used to sound aerosols. Lidar systems installed on a research vessel helped to resolve aerosol concentration profiles up to 10 km and water vapor concentration profiles up to 1.5 km in height. Stationary coastal lidar ensured the height of aerosol sounding up to 30 km. In the atmosphere/ocean interlayer, the height distribution of aerosol concentrations and humidity fields for various meteorological situations has been studied. The data are obtained for the inverse humidity layers formed 100 to 300 m over the ocean which cause the formation of aerosol layers with greater concentration. GRA

N91-27622# Naval Civil Engineering Lab., Port Hueneme, CA.
LITERATURE REVIEW: COMPUTER AIDED ASSESSMENT TECHNIQUES FOR NONPOINT SOURCE DISCHARGES Final Report, Aug. - Feb. 1990
J. C. Heath, L. A. Karr, L. W. Canter, M. Lahlou, and T. A. Cooper Apr. 1991 66 p
(NR Proj. Y08-17)
(AD-A236347; NCEL-TN-1830) Avail: NTIS HC/MF A04 CSCL 12/7

Computer models and geographic information systems (GIS's) are valuable tools for assessing nonpoint source discharges. Because of the diffused nature and variable flow associated with storm water run-off, it is difficult to design an inexpensive sampling program to assess the impact of nonpoint source pollution. Computer modeling and GIS's can help process limited data and make assessments of nonpoint source discharges from both surface water and groundwater sources. Modeling approaches range from simple loading function calculations to the use of sophisticated hydrological and water quality-oriented computer software. The GIS's have great potential for reducing the cost of assessing nonpoint source pollution. GRA

N91-27623# Army Lab. Command, Fort Monmouth, NJ. Electronics Technology and Devices Lab.
THE IMPACT OF CLEAN AIR IN THE 1990'S Technical Report, Jan. - Dec. 1990
Paul C. Manz Apr. 1991 11 p
(AD-A236526; SLCET-TR-91-7) Avail: NTIS HC/MF A03 CSCL 24/1

The legislative and executive branches of the Government have been working on a complete, comprehensive revision of the existing Clean Air statuses which would tighten pollution control on motor vehicle and industrial emission and establish compliance deadlines for both industrial activities and individual states and regions. This revision of public policy is designed to reduce and/or eliminate the continued release of hazardous materials into the air from both fugitive and point effluent sources. The materials addressed are either hazardous or toxic to humans, terrestrial animals, aquatic life, and the balanced ecosystems of the biosphere. The legislation is aimed at public health concerns and environmental impact. GRA

N91-27624# National Oceanic and Atmospheric Administration, Boulder, CO. Wave Propagation Lab.
DIURNAL AND ANNUAL VARIATIONS IN MEAN PROFILES OF Cn2
C. W. Fairall and A. S. Frisch Mar. 1991 42 p
(PB91-181719; NOAA-TM-ERL-WPL-195) Avail: NTIS HC/MF A03 CSCL 13B

Individual profiles of turbulent refractive index structure function parameter, (C sub n, sup 2) exhibit considerable vertical structure and temporal variability. The planetary boundary layer (PBL) is characterized by significant diurnal variations over land because of the daily solar heating cycle. Above the PBL, the turbulence is primary due to instabilities associated with breaking gravity waves and local fluctuations due to a broad spectrum of gravity waves. A typical average (C sub n, sup 2) profile for optical wavelengths that takes these physical differences into account by considering the PBL and free atmosphere separately was constructed. Physical models of turbulence in these two regimes are used as a basis for constructing the climatology. GRA

N91-27625# Environmental Protection Agency, Research Triangle Park, NC. Air and Energy Engineering Research Lab.
EPA'S GLOBAL CLIMATE CHANGE PROGRAM. PROGRAM PLAN FOR METHANE EMISSIONS FROM LANDFILLS AND OTHER WASTE DISPOSAL FACILITIES
S. A. Thorneloe 26 Mar. 1991 19 p Presented at the 14th Solid Waste Association Meeting of North America'a Annual International Landfill Gas Symposium, San Diego, CA, 26 Mar. 1991
(PB91-182667; EPA/600/D-91/053) Avail: NTIS HC/MF A03 CSCL 13B

A portion of EPS's global climate change program, a program plan for methane emissions from landfills and other waste disposal facilities, are discussed. In response to concerns about global change, an emissions and mitigation program has been initiated. Research has begun on greenhouse gas emission estimation, biomass and methane utilization, tropospheric ozone, and evaluation of potential mitigation opportunities for emissions contributing to global climate change. The emissions program has begun to identify and quantify emission sources of greenhouse gases for anthropogenic sources including landfills, coal mines, natural gas production/distribution, cookstoves, and biomass burning. Development of enhanced emission estimates will improve the understanding of atmospheric chemistry and feedback effects, target mitigation opportunities, and ensure cost effective mitigation strategies. Author

N91-27626# National Telecommunications and Information Administration, Boulder, CO. Inst. for Telecommunication Sciences.
ATMOSPHERIC 60-GHz OXYGEN SPECTRUM: MODELING AND LABORATORY MEASUREMENTS
H. J. Liebe, G. A. Hufford, and R. O. DeBolt Mar. 1991 171 p
(PB91-172809; NTIA-91-272) Avail: NTIS HC/MF A08 CSCL 13B

Molecular oxygen dominates the attenuation and delay rates of dry air throughout the V-band. Both rates display as a function of altitude an intricate pattern which, for the most part, has never been confirmed by experiment. The collective spectral behavior of 38 pressure broadened O2 lines is described by a complex (230 coefficients) prediction model (MPM89). For atmospheric conditions of pressure equivalent to altitudes between sea level and 30 km, this behavior was studied under controlled laboratory conditions. The spectrometer consisted of a one-port Fabry-Perot resonator, which was excited by an automatic network analyzer. All operations were controlled by a microcomputer, including reference level calibrations at multiple resonances and control of the pressure steps. Introducing gas into the spectrometer cell changed the detected resonance response, from which was deduced a complex refractivity by means of a twin, nonlinear least squares method. The analysis of dry air measurements concentrated on the loss part, expressed as attenuation rate alpha in dB/km. The detection sensitivity was +/- 0.01 dB/km for an effective path length of 0.24 km and a 5 percent coupling ratio of a resonance response. Coupling to a particular resonance and the duration of a measurement sequence influenced the spectrometer performance. Over 4300 attenuation values are reported. The results were measured between 53.9 and 66.3 GHz in 0.1 GHz frequency increments at eleven pressure steps for three temperatures. The measurement uncertainties were estimated to be typically +/- 0.005 below 3 dB/km and +/- 2 percent for higher values. A first comparison of experimental results with MPM89 predictions revealed, in addition to random data scatter, systematic differences that correlate with line broadening and overlap parameters. GRA

N91-27627# Computer Sciences Corp., Research Triangle Park, NC.
REGIONAL OXIDANT MODEL USER'S GUIDE. PART 3: THE CORE MODEL Final Report, Aug. 1989 - Jan. 1991
J. Young, L. Milich, and D. Jorge Jan. 1991 285 p
(Contract EPA-68-01-7365)
(PB91-171942-Pt-3; EPA/600/8-90/083C-Pt-3; PB91-171918-Pt-3) Avail: NTIS HC/MF A13; also avail. in set of 3 reports HC/MF E99, as PB91-171918 CSCL 13B

An overview of the core model of the Regional Oxidant Model (ROM) that determines the hourly concentrations and fates of ozone and 34c other chemical species over a scale of 1000 km by 1000 km for ozone episodes of up to one month's duration is given. The structure of the model is discussed. The core model input files are discussed. Author

N91-27628# Rijksinstituut voor de Volksgezondheid, Bilthoven (Netherlands).
EFFECT OF AIRCRAFT EMISSIONS ON ATMOSPHERIC OZONE IN THE NORTHERN HEMISPHERE
J. P. Beck, C. E. Reeves, F. A. A. M. deLeeuw, and S. A. Penkett Jun. 1990 100 p Prepared in cooperation with East Anglia Univ., Norwich (England) Sponsored in part by Ministerie van Volkshuisvesting, Ruimtelijke Ordening en Milieubeheer
(PB91-172072; RIVM-222201001) Avail: NTIS HC/MF A05 CSCL 13B

Since the 1960's there has been intensive research leading to increased understanding of the processes controlling the ozone budget in both the troposphere and stratosphere. Anthropogenic emissions of NO(x) and hydrocarbons, which play at low level most of the time. However, the exhaust gases of aircraft are injected directly into higher altitudes and therefore immediately affect the chemistry at these altitude levels. In the present work the effects of subsonic aircraft emissions in the chemical composition of the troposphere are studied in this particular part of the atmosphere in more detail. This is done by using a channel model, which describes the meteorology and chemistry of the atmosphere between 30 degrees and 60 degrees north. A literature overview of the effects of aircraft emissions and a description of the channel model are presented. The construction of the emission inventory is described. The results of several model runs plus interpretation and discussion of the results are presented, and conclusions are summarized. GRA

N91-27629# National Ocean Service, Rockville, MD.
REPORT TO THE CONGRESS ON OCEAN POLLUTION, MONITORING, AND RESEARCH, OCTOBER 1988 THROUGH SEPTEMBER 1989
Aug. 1990 82 p
(PB91-172361) Avail: NTIS HC/MF A05 CSCL 13B

The report is presented which is structured along organizational and programmic lines, and emphasizes the activities and accomplishments of the Ocean Assessments Division and the National Ocean Pollution Program Office. As in other recent annual reports, only those monitoring, research, and assessment activities that receive NOAA support under either Title 2 of the MPRSA or Sections 4, 6, or 8 of NOPP are described. Activities currently conducted under the program include: a cooperative interagency analysis of marine pollution issues and priorities, and planning the necessary research and monitoring strategies to meet these priorities, a national program to assess the status and trends of coastal marine and estuarine environmental quality, including a NOAA quality assurance program for analytical measurements, a program to assess the effects of selected toxic chemicals on populations of living marine resources, and a national capability to provide scientific oil and hazardous materials and during cleanup of hazardous waste sites in coastal areas. GRA

N91-27630# Environmental Protection Agency, Research Triangle Park, NC. Air and Energy Engineering Research Lab.
ACID RAIN CONTROL OPTIONS
Frank T. Princiotta 1990 26 p Presented at the Electric Power Industry and the New Clean Air Act, Washington, DC, 10-11 Dec. 1990
(PB91-162545; EPA/600/D-90/240) Avail: NTIS HC/MF A03 CSCL 13B

Acid rain control options available to the electric utility industry are discussed. They include coal switching, flue gas desulfurization, and such emerging lower cost technologies as: Limestone Injection Multistage Burners (LIMB's) and advanced silicate (ADVACATE), both developed by EPA; selective use of gas to reduce nitrogen oxides and sulfur dioxide in coal fired boilers; and the use of integrated coal gasification combined cycle (IGCC) technology. GRA

N91-27631# Environmental Protection Agency, Research Triangle Park, NC. Atmospheric Research and Exposure Assessment Lab.
AN ADVANCED SCREENING MODEL FOR COMPLEX TERRAIN APPLICATIONS
Donna J. Burns, Steven G. Perry, and Alan J. Cimorelli (Environmental Protection Agency, Philadelphia, PA.) 1991 14 p
(PB91-162693; EPA/600/D-91/005) Avail: NTIS HC/MF A03 CSCL 13B

A methodology was developed to use the advanced techniques of the Complex Terrain Dispersion Model in situations where on-site meteorological measurements are limited or unavailable. The approach, known as CTSCREEN, uses actual source and terrain characteristics to model plume impacts with an extensive array of predetermined meteorological conditions. The CTSCREEN compares favorably with other complex terrain screening models (ones that require collection of on-site meteorological data) and is a great improvement over screening models that also use predetermined meteorology. GRA

46 GEOPHYSICS

Includes aeronomy; upper and lower atmosphere studies; ionospheric and magnetospheric physics; and geomagnetism.

For space radiation see *93 Space Radiation.*

N91-27632*# International Council of Scientific Unions, Urbana, IL. Scientific Committee on Solar-Terrestrial Physics.
MIDDLE ATMOSPHERE PROGRAM. HANDBOOK FOR MAP. VOLUME 31: REFERENCE MODELS OF TRACE SPECIES FOR THE COSPAR INTERNATIONAL REFERENCE ATMOSPHERE
G. M. Keating, ed. (National Aeronautics and Space Administration. Langley Research Center, Hampton, VA.) Urbana, IL. Dec. 1989 186 p Workshop held in Espoo, Finland, 18 Jul. 1988; sponsored in part by IAGA, IAMAP, SCOSTEP, and URSI Sponsored by NASA and UNESCO
(Contract MAP-Handbook-31)
(NASA-CR-188625; NAS 1.26:188625) Avail: NTIS HC/MF A09; also available from SCOSTEP Secretariat, Illinois Univ., 1406 Green Street, Urbana, IL 61801 CSCL 04A

A set of preliminary reference atmosphere models of significant trace species which play important roles in controlling the chemistry, radiation budget, and circulation patterns of the atmosphere were produced. These models of trace species distributions are considered to be reference models rather than standard models; thus, it was not crucial that they be correct in an absolute sense. These reference models can serve as a means of comparison between individual observations, as a first guess in inversion algorithms, and as an approximate representation of observations for comparison to theoretical calculations. For individual titles, see N91-27633 through N91-27644.

N91-27633*# National Aeronautics and Space Administration. Langley Research Center, Hampton, VA.
OZONE REFERENCE MODELS FOR THE MIDDLE ATMOSPHERE (NEW CIRA)
G. M. Keating, M. C. Pitts, and D. F. Young (Kentron International, Inc., Hampton, VA.) *In* International Council of Scientific Unions,

Middle Atmosphere Program. Handbook for MAP. Volume 31: Reference Models of Trace Species for the COSPAR International Reference Atmosphere Dec. 1989 p 1-36 (For primary document see N91-27632 19-46)
Avail: NTIS HC/MF A09; also available from SCOSTEP Secretariat, Illinois Univ., 1406 Green Street, Urbana, IL 61801 CSCL 04A

Models of ozone vertical structure were generated that were based on multiple data sets from satellites. The very good absolute accuracy of the individual data sets allowed the data to be directly combined to generate these models. The data used for generation of these models are from some of the most recent satellite measurements over the period 1978 to 1983. A discussion is provided of validation and error analyses of these data sets. Also, inconsistencies in data sets brought about by temporal variations or other factors are indicated. The models cover the pressure range from from 20 to 0.003 mb (25 to 90 km). The models for pressures less than 0.5 mb represent only the day side and are only provisional since there was limited longitudinal coverage at these levels. The models start near 25 km in accord with previous COSPAR international reference atmosphere (CIRA) models. Models are also provided of ozone mixing ratio as a function of height. The monthly standard deviation and interannual variations relative to zonal means are also provided. In addition to the models of monthly latitudinal variations in vertical structure based on satellite measurements, monthly models of total column ozone and its characteristic variability as a function of latitude based on four years of Nimbus 7 measurements, models of the relationship between vertical structure and total column ozone, and a midlatitude annual mean model are incorporated in this set of ozone reference atmospheres. Various systematic variations are discussed including the annual, semiannual, and quasibiennial oscillations, and diurnal, longitudinal, and response to solar activity variations. Author

N91-27634*# National Aeronautics and Space Administration. Langley Research Center, Hampton, VA.
IMPROVED REFERENCE MODELS FOR MIDDLE ATMOSPHERE OZONE
G. M. Keating, M. C. Pitts, and C. Chen (ST Systems Corp., Hampton, VA.) *In* International Council of Scientific Unions, Middle Atmosphere Program. Handbook for MAP. Volume 31: Reference Models of Trace Species for the COSPAR International Reference Atmosphere Dec. 1989 p 37-49 (For primary document see N91-27632 19-46)
Avail: NTIS HC/MF A09; also available from SCOSTEP Secretariat, Illinois Univ., 1406 Green Street, Urbana, IL 61801 CSCL 04A

Improvements are provided for the ozone reference model which is to be incorporated in the COSPAR International Reference Atmosphere (CIRA). The ozone reference model will provide considerable information on the global ozone distribution, including ozone vertical structure as a function of month and latitude from approximately 25 to 90 km, combining data from five recent satellite experiments (Nimbus 7 LIMS, Nimbus 7 SBUV, AE-2 SAGE, Solar Mesosphere Explorer (SME) UVS, and SME IR). The improved models are described and use reprocessed AE-2 SAGE data (sunset) and extend the use of SAGE data from 1981 to the period 1981-1983. Comparisons are shown between the ozone reference model and various nonsatellite measurements at different levels in the middle atmosphere. Author

N91-27635*# National Aeronautics and Space Administration. Langley Research Center, Hampton, VA.
AN INTERIM REFERENCE MODEL FOR THE VARIABILITY OF THE MIDDLE ATMOSPHERE H2O VAPOR DISTRIBUTION
E. E. Remsberg, J. M. Russell, III, and C. Y. Wu (ST Systems Corp., Hampton, VA.) *In* International Council of Scientific Unions, Middle Atmosphere Program. Handbook for MAP. Volume 31: Reference Models of Trace Species for the COSPAR International Reference Atmosphere Dec. 1989 p 50-66 (For primary document see N91-27632 19-46)
Avail: NTIS HC/MF A09; also available from SCOSTEP Secretariat, Illinois Univ., 1406 Green Street, Urbana, IL 61801 CSCL 04A

Water vapor is an important minor constituent in the studies of the middle atmosphere for a variety of reasons, including its role as a source for active HO(y) chemicals and its use in analysis of transport processes. A number of in situ and remote techniques were employed in the determination of water vapor distributions. Two of the more complete data sets were used to develop an interim reference profile. First, there are the seven months of Nimbus 7 limb infrared monitor of the stratosphere (LIMS) data obtained during Nov. 1978 to May 1979 over the range 64S to 84N latitude and from about 100 to 1 mb in the mid-mesosphere at several fixed Northern Hemisphere mid-latitude sites. These two data sets were combined to give a mid-lattitude, interim reference water vapor profile for the entire vertical range of the middle atmosphere and with accuracies of better than 25 percent. The daily variability of stratospheric water vapor profiles about the monthly mean was also established from these data sets for selected months. Information is also provided on the longitudinal variability of LIMS water vapor profiles about the daily, weekly, and monthly zonal means. Generally, the interim reference water vapor profile and its variability are consistent with prevailing ideas about chemistry and transport. Author

N91-27636*# Oxford Univ. (England). Dept. of Atmospheric Physics.
PROPOSED REFERENCE MODELS FOR NITROUS OXIDE AND METHANE IN THE MIDDLE ATMOSPHERE
F. W. Taylor, A. Dudhia, and C. D. Rodgers *In* International Council of Scientific Unions, Middle Atmosphere Program. Handbook for MAP. Volume 31: Reference Models of Trace Species for the COSPAR International Reference Atmosphere Dec. 1989 p 67-79 (For primary document see N91-27632 19-46)
Avail: NTIS HC/MF A09; also available from SCOSTEP Secretariat, Illinois Univ., 1406 Green Street, Urbana, IL 61801 CSCL 04A

Data from the Stratospheric and Mesospheric Sounder (SAMS) on the Nimbus 7 satellite, for the period from Jan. 1979 - Dec. 1981, are used to prepare a reference model for the long-lived trace gases, methane and nitrous oxide, in the stratosphere. The model is presented in tabular form on seventeen pressure surfaces from 20 to 0.1 mb, in 10 degree latitude bins from 50S to 70N, and for each month of the year. The means by which the data quality and interannual variability, and some of the more interesting globally and seasonally variable features of the data are discussed briefly. Author

N91-27637*# Oxford Univ. (England). Dept. of Atmospheric, Oceanic and Planetary Physics.
REFERENCE MODEL FOR CH4 AND N2O AND TRENDS
F. W. Taylor and A. Dudhia *In* International Council of Scientific Unions, Middle Atmosphere Program. Handbook for MAP. Volume 31: Reference Models of Trace Species for the COSPAR International Reference Atmosphere Dec. 1989 p 80-84 (For primary document see N91-27632 19-46)
Avail: NTIS HC/MF A09; also available from SCOSTEP Secretariat, Illinois Univ., 1406 Green Street, Urbana, IL 61801 CSCL 04A

Data from the Stratospheric and Mesospheric Sounder on Nimbus 7 were used as the basis for a model of the abundances of nitrous oxide and methane in the stratosphere. A version of this was produced two years ago (Taylor, Dudhia, and Rodgers - hereafter called the original paper) and in this new paper some of the possible error sources and long term trends are considered in more detail. The principle source of error in the SAMS retrievals is thought to be the use of climatological ozone profiles to invert the temperature profile data. However, it was found that the effect is too small, and of the opposite sign, to explain the discrepancies between satellite and in situ measurements, noted in the original paper. As expected, no systematic trends which exceed the

estimated error in the data are found in either methane or nitrous oxide. Author

N91-27638*# National Oceanic and Atmospheric Administration, Boulder, CO.
REVISED REFERENCE MODEL FOR NITRIC ACID
J. C. Gille, P. L. Bailey, and C. A. Craig *In* International Council of Scientific Unions, Middle Atmosphere Program. Handbook for MAP. Volume 31: Reference Models of Trace Species for the COSPAR International Reference Atmosphere Dec. 1989 p 85-98 (For primary document see N91-27632 19-46)
(NASA Order W-16215)
Avail: NTIS HC/MF A09; also available from SCOSTEP Secretariat, Illinois Univ., 1406 Green Street, Urbana, IL 61801 CSCL 04A

A nearly global set of data on the nitric acid distribution was obtained for seven months by the Limb Infrared Monitor of the Stratosphere (LIMS) experiment on the Nimbus 7 spacecraft. The evaluation of the accuracy, precision, and resolution of these data is described, and a description of the major features of the nitric acid distributions is presented. The zonal mean for nitric acid is distributed in a stratospheric layer that peaks near 30 mb, with the largest mixing ratios occurring in polar regions, especially in winter. Author

N91-27639*# Max-Planck-Inst. fuer Aeronomie, Katlenburg-Lindau (Germany, F.R.).
PROPOSED REFERENCE MODELS FOR CO2 AND HALOGENATED HYDROCARBONS
P. Fabian *In* International Council of Scientific Unions, Middle Atmosphere Program. Handbook for MAP. Volume 31: Reference Models of Trace Species for the COSPAR International Reference Atmosphere Dec. 1989 p 99-108 Sponsored in part by Federal Ministry of Research and Technology (For primary document see N91-27632 19-46)
Avail: NTIS HC/MF A09; also available from SCOSTEP Secretariat, Illinois Univ., 1406 Green Street, Urbana, IL 61801 CSCL 04A

The vertical distribution of carbon dioxide, halocarbons and their sink products, HCl and HF, have become available, mainly by means of balloon measurements. Most measurements were made at northern mid-latutudes, but some constituents were measured at tropical latitudes and in the Southern Hemisphere as well. An attempt is made here to combine the available data for presentation of reference models for CO2, CCl4 CCl3F, CCl2F2, CClF3, CF4, CCl2F-CClF2, CClF2-CClF2, CClF2-CF3, CF3-CF3, CH3Cl, CHClF2, CH3-CCl3, CBrClF2, CBrF3, HCl and HF.
Author

N91-27640*# National Aeronautics and Space Administration. Langley Research Center, Hampton, VA.
BACKGROUND STRATOSPHERIC AEROSOL REFERENCE MODEL
M. P. McCormick and P. Wang (Science and Technology Corp., Hampton, VA.) *In* International Council of Scientific Unions, Middle Atmosphere Program. Handbook for MAP. Volume 31: Reference Models of Trace Species for the COSPAR International Reference Atmosphere Dec. 1989 p 109-116 (For primary document see N91-27632 19-46)
Avail: NTIS HC/MF A09; also available from SCOSTEP Secretariat, Illinois Univ., 1406 Green Street, Urbana, IL 61801 CSCL 04A

In this analysis, a reference background stratospheric aerosol optical model is developed based on the nearly global SAGE 1 satellite observations in the non-volcanic period from March 1979 to February 1980. Zonally averaged profiles of the 1.0 micron aerosol extinction for the tropics and the mid- and high-altitudes for both hemispheres are obtained and presented in graphical and tabulated form for the different seasons. In addition, analytic expressions for these seasonal global zonal means, as well as the yearly global mean, are determined according to a third order polynomial fit to the vertical profile data set. This proposed background stratospheric aerosol model can be useful in modeling studies of stratospheric aerosols and for simulations of atmospheric radiative transfer and radiance calculations in atmospheric remote sensing. Author

N91-27641*# National Center for Atmospheric Research, Boulder, CO.
COMPARISON BETWEEN OBSERVED AND CALCULATED DISTRIBUTIONS OF TRACE SPECIES IN THE MIDDLE ATMOSPHERE
G. Brasseur and A. DeRudder (Institut d'Aeronomie Spatiale de Belgique, Brussels.) *In* International Council of Scientific Unions, Middle Atmosphere Program. Handbook for MAP. Volume 31: Reference Models of Trace Species for the COSPAR International Reference Atmosphere Dec. 1989 p 117-125 (For primary document see N91-27632 19-46)
Avail: NTIS HC/MF A09; also available from SCOSTEP Secretariat, Illinois Univ., 1406 Green Street, Urbana, IL 61801 CSCL 04A

The purpose is to identify major discrepancies between empirical models and theoretical models and to stress the need for additional observations in the atmosphere and for further laboratory work, since these differences suggest either problems associated with observation techniques or errors in chemical kinetics data (or the existence of unknown processes which appear to play an important role). The model used for this investigation extends from the earth's surface to the lower thermosphere. It includes the important chemical and photochemical processes related to the oxygen, hydrogen, carbon, nitrogen and chlorine families. The chemical code is coupled with a radiative scheme which provides the heating rate due to absorption of solar radiation by ozone and the cooling rate due to the emission and absorption of terrestrial radiation by CO2, H2O and O3. The vertical transport of the species is expressed by an eddy diffusion parameterization. Author

N91-27642*# Colorado Univ., Boulder.
REFERENCE MODELS FOR THERMOSPHERIC NO
C. A. Barth *In* International Council of Scientific Unions, Middle Atmosphere Program. Handbook for MAP. Volume 31: Reference Models of Trace Species for the COSPAR International Reference Atmosphere Dec. 1989 p 126-138 (For primary document see N91-27632 19-46)
Avail: NTIS HC/MF A09; also available from SCOSTEP Secretariat, Illinois Univ., 1406 Green Street, Urbana, IL 61801 CSCL 04A

Nitric oxide has been measured with an ultraviolet spectrometer on the polar-orbiting satellite Solar Mesosphere Explorer (SME) for the period January 1982 to August 1986. The nitric oxide database contains densities at all latitudes sorted into 5 degree bins and at altitudes between 100 and 140 km sorted into 3.3 km-bins. The largest densities occur at latitudes in the auroral zones where the density varies as a function of geomagnetic activity. Variations of a factor of 10 occur between times of intense activity and quiet times. At low latitudes, the nitric oxide density at 110 km varies from a mean value of 3 times 10(exp 7) molecules per cubic cm in January 1982 to a mean value of 4 times 10(exp 6) molecules per cubic cm during solar minimum conditions in 1986. In addition, the low-latitude nitric oxide density varies plus or minus 50 percent with a period of 27 days during times of high solar activity. Author

N91-27643*# Saskatchewan Univ., Saskatoon. Inst. of Space and Atmospheric Studies.
PROPOSED REFERENCE MODELS FOR ATOMIC OXYGEN IN THE TERRESTRIAL ATMOSPHERE
E. J. Llewellyn, I. C. McDade, and M. D. Lockerbie *In* International Council of Scientific Unions, Middle Atmosphere Program. Handbook for MAP. Volume 31: Reference Models of Trace Species for the COSPAR International Reference Atmosphere Dec. 1989 p 139-154 (For primary document see N91-27632 19-46)
Avail: NTIS HC/MF A09; also available from SCOSTEP Secretariat, Illinois Univ., 1406 Green Street, Urbana, IL 61801 CSCL 04A

A provisional Atomic Oxygen Reference model was derived from average monthly ozone profiles and the MSIS-86 reference model atmosphere. The concentrations are presented in tabular form for the altitude range 40 to 130 km. Author

N91-27644*# University Coll., London (England). Dept. of Physics and Astronomy.

NUMERICAL SIMULATIONS OF THE SEASONAL/LATITUDINAL VARIATIONS OF ATOMIC OXYGEN AND NITRIC OXIDE IN THE LOWER THERMOSPHERE AND MESOSPHERE

D. Rees and T. J. Fuller-Rowell *In* International Council of Scientific Unions, Middle Atmosphere Program. Handbook for MAP. Volume 31: Reference Models of Trace Species for the COSPAR International Reference Atmosphere Dec. 1989 p 155-179 Sponsored in part by Science Research Council (For primary document see N91-27632 19-46)

(Grant AF-AFOSR-0341-86)

Avail: NTIS HC/MF A09; also available from SCOSTEP Secretariat, Illinois Univ., 1406 Green Street, Urbana, IL 61801 CSCL 04A

A 2-Dimensional zonally-averaged thermospheric model and the global University College London (UCL) thermospheric model have been used to investigate the seasonal, solar activity and geomagnetic variation of atomic oxygen and nitric oxide. The 2-dimensional model includes detailed oxygen and nitrogen chemistry, with appropriate completion of the energy equation, by adding the thermal infrared cooling by O and NO. This solution includes solar and auroral production of odd nitrogen compounds and metastable species. This model has been used for three investigations; firstly, to study the interactions between atmospheric dynamics and minor species transport and density; secondly, to examine the seasonal variations of atomic oxygen and nitric oxide within the upper mesosphere and thermosphere and their response to solar and geomagnetic activity variations; thirdly, to study the factor of 7 to 8 peak nitric oxide density increase as solar F sub 10.7 cm flux increases from 70 to 240 reported from the Solar Mesospheric Explorer. Auroral production of NO is shown to be the dominant source at high latitudes, generating peak NO densities a factor of 10 greater than typical number densities at low latitudes. At low latitudes, the predicted variation of the peak NO density, near 110 km, with the solar F sub 10.7 cm flux is rather smaller than is observed. This is most likely due to an overestimate of the soft X-ray flux at low solar activity, for times of extremely low support number, as occurred in June 1986. As observed on pressure levels, the variation of O density is small. The global circulation during solstice and periods of elevated geomagnetic activity causes depletion of O in regions of upwelling, and enhancements in regions of downwelling. Author

N91-27645*# Massachusetts Inst. of Tech., Cambridge. Dept. of Earth, Atmospheric, and Planetary Sciences.

LATERAL VARIATION IN UPPER MANTLE TEMPERATURE AND COMPOSITION BENEATH MID-OCEAN RIDGES INFERRED FROM SHEAR-WAVE PROPAGATION, GEOID, AND BATHYMETRY Ph.D. Thesis

Anne Francis Sheehan Jun. 1991 258 p

(Grants NAG5-814; NSF EAR 88-17173; NSF EAR-90-04750) (NASA-CR-188603; NAS 1.26:188603) Copyright Avail: NTIS HC/MF A12 CSCL 08E

Resolution of both the extent and mechanism of lateral heterogeneity in the upper mantle constraints the nature and scales of mantle convection. Oceanic regions are of particular interest as they are likely to provide the closest glimpse at the patterns of temperature anomalies and convective flow in the upper mantle because of their young age and simple crustal structure relative to continental regions. Lateral variations were determined in the seismic velocity and attenuation structure of the lithosphere and astenosphere beneath the oceans, and these seismological observations were combined with the data and theory of geoid and bathymetry anomalies in order to test and improve current models for seafloor spreading and mantle convection. Variations were determined in mantle properties on a scale of about 1000 km, comparable to the thickness of the upper mantle. Seismic velocity, geoid, and bathymetry anomalies are all sensitive to variations in upper mantle density, and inversions were formulated to combine quantitatively these different data and to search for a common origin. Variations in mantle density can be either of thermal or compositional origin and are related to mantle convection or differentiation. Author

N91-27646*# Colorado Univ., Boulder. Dept. of Astrophysical, Planetary, and Atmospheric Sciences.

STUDIES OF MAGNETOPAUSE STRUCTURE Final Report, 15 Mar. 1987 - 31 Jul. 1991

Theodore W. Speiser 31 Jul. 1991 6 p

(Grant NAGw-1054)

(NASA-CR-188639; NAS 1.26:188639) Avail: NTIS HC/MF A02 CSCL 04A

From the International Sun-Earth Explorers (ISEE) 1 magnetopause crossings on November 10, 1977, three-dimensional distribution functions for energetic ions were studied in the magnetosphere, through the magnetopause, and in the magnetosheath (Speiser and Williams, 1982). The particle distributions were particularly examined at and near the times that Russell and Elphic (1978) identified as flux transfer events (FTE). Using a simple, one-dimensional, quasi-static model, particle orbits were followed numerically, from the magnetosphere into the sheath. The inner, trapped, distribution initializes the distribution function. Liouville's theorem allows the inner distribution to be mapped into the sheath following the orbits. This mapping is shown for four mangetosheath ion flows (MIF's) corresponding to four flux transfer events. Results from the studies are discussed. A brief discussion of current sheet particle motion is presented. Author

N91-27647 Bureau of Mineral Resources, Geology and Geophysics, Canberra (Australia). Onshore Sedimentary and Petroleum Geology Program.

GEOLOGICAL AND GEOPHYSICAL STUDIES IN THE AMADEUS BASIN, CENTRAL AUSTRALIA, BULLETIN 236

Russell J. Korsch, ed., comp. and J. M. Kennard, ed., comp. 1991 594 p Original contains color illustrations

(BMR-Bull-236; ISBN-0-642-15864-9; ISSN-0084-7089) Copyright Avail: Issuing Activity; 15 functional color pages

The Amadeus Basin is one of Australia's most important sedimentary basins, both scientifically and economically. Scientifically its significance stems from the fact that it contains some of Austrailia's best preserved and best exposed Proterozoic and Palaeozoic sequences which provide insight into the early history of the continent. Economically, it derives its importance from the fact that those same sequences host commercially exploitable oil, gas, and groundwater as well as resources of potential future value such as evaporites and phosphate. Papers from research projects conducted on the Amadeus Basin are presented with respect to the above topics. For individual titles, see N91-27648 through N91-27683.

N91-27648# Bureau of Mineral Resources, Geology and Geophysics, Canberra (Australia).

THE EVOLUTION OF THE AMADEUS BASIN, CENTRAL AUSTRALIA

John F. Lindsay and Russell J. Korsch *In its* Geological and Geophysical Studies in the Amadeus Basin, Central Australia, Bulletin 236 1991 p 7-32 (For primary document see N91-27647 19-46)

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A number of broad, shallow, intracratonic depressions formed on the Australian craton during the Late Proterozoic and Early Palaeozoic. The development of these basins relates to the breakup of a Proterozoic supercontinent and, in large part, basin dynamics appears to be tied to this global tectonic event. The Amadeus Basin, which is typical of these intracratonic basins, contains a complex Late Proterozoic to mid-Palaeozoic depositional succession which locally reaches 14 km in thickness. The application of sequence stratigraphy to this succession has provided an effective framework in which to evaluate its evolution.

Analysis of major depositional sequences shows that the Amadeus Basin evolve in three main stages. Stage one began at about 900 Ma with an extensional and/or thermal event followed by subsidence driven by thermal relaxation of the lithosphere. A second, less intense, episode of extension (stage two) occurred towards the end of the Late Proterozoic. Stage two subsidence was followed by a major compressional event (stage three), beginning at about 450 Ma, in which major southward-directed thrust sheets caused progressive downward flexing of the northern margin of the basin, and sediment was shed from the thrust sheets into the downwraps to form a foreland basin. This event shortened the basin by 50 to 100 km and effectively concluded sedimentation. The two major stages of complex crustal extension and thermal recovery produced large-scale apparent sea-level effects upon which eustatic sea-level cycles are superimposed. Basin dynamics created depositional space and determined the location of major depocentres, whereas eustacy determined the timing of sequence boundaries and the distribution of facies associations. Since the style of sedimentation and major sequence boundaries were controlled to a large degree by basin dynamics and eustacy, depositional patterns within the Amadeus and associated basins are, to a large degree, predictable. This suggests that an understanding of major variables associated with basin dynamics and their relationship to depositional sequences may allow the development of generalized depositional models on a basinal scale. Thus, it appears that sequence stratigraphy can be used as a basis for inter-regional correlation, a possibility that has considerable significance in unfossiliferous Archaean and Proterozoic basins. Author

N91-27649# Bureau of Mineral Resources, Geology and Geophysics, Canberra (Australia).

AMADEUS BASIN, NORTHERN TERRITORY: STRUCTURE FROM GRAVITY AND MAGNETIC ANOMALIES

Peter Wellman *In its* Geological and Geophysical Studies in the Amadeus Basin, Central Australia, Bulletin 236 1991 p 33-40 (For primary document see N91-27647 19-46)

Avail: Issuing Activity; 15 functional color pages

Both magnetic and geological information show a broad-striking, basement ridge, generally 3 to 4 km deep, along the axis of the Amadeus Basin. To the north of the basement ridge, residual gravity lows overlie a series of 6 to 12 km deep troughs, and to the south there is a broad, relatively shallow basin. Similar gravity lows may overlie other troughs under nappes to the northeast and beneath cover rocks to the southeast. Depths to magnetic basement average about 1 km deeper than depths to basement inferred from mapped geology and formation thickness, so in some areas there may be additional non-magnetic rocks above basement. Over much of the basin, the locations of residual gravity and magnetic anomalies are not consistent with a cause from surface anticlines or from basement ridges underlying anticlines. They are inferred to be due to basement ridges displaced from the surface anticlines; some may be due to structures in the basement. The dominant basement structural trend is northwest over most of the basin; in the southeast and in a band across the center of the basin; however, the trend is northeast. These basement structural trends may be due to transfer faults. Author

N91-27650# Bureau of Mineral Resources, Geology and Geophysics, Canberra (Australia).

SEISMIC REFLECTION AND REFRACTION PROFILING IN CENTRAL AUSTRALIA: IMPLICATIONS FOR UNDERSTANDING THE EVOLUTION OF THE AMADEUS BASIN

C. Wright, B. R. Goleby, Russell D. Shaw, C. D. N. Collins, Russell J. Korsch, T. Barton, S. A. Greenhalgh, and S. Sugiharto (Sceptre Resources Pty. Ltd., Jakarta, Indonesia) *In its* Geological and Geophysical Studies in the Amadeus Basin, Central Australia, Bulletin 236 1991 p 41-57 (For primary document see N91-27647 19-46)

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Seismic reflection sections for the Arunta Block generally show abundant, steep, north-dipping events that are interpreted as reflections from dipping faults, many of which are evident in surface geological mapping. The Redbank Thrust Zone, a major thrust feature, has been imaged to depths of at least 30 km. South of the Redbank Thrust Zone, steep, north-dipping reflections are generally absent; subhorizontal basement reflections predominate below the Southern Arunta Province and Amadeus Basin. Beneath the Southern Arunta Province, a zone of strong reflections dipping gently to the north occurs at depths between 21 and 30 km. A similar zone of south-dipping reflections is observed between depths of 18 and 30 km over a distance of about 40 km in the southern platform region of the Amadeus Basin. A south-dipping thrust fault has also been imaged to depths of 18 km near the southern limit of the reflection profile. These results suggest that the basement south of the Redbank Thrust Zone to the southern margin of the Amadeus Basin forms a single tectonic province. The seismic reflection data also provide support for a 'thick-skinned' style of tectonic deformation in the Arunta Block, and probably in the Musgrave Block too. The seismic refraction profiles indicate that the crust is on average more than 50 km thick below both the border region between the Central and Southern Arunta Provinces and the northern part of the Amadeus Basin, providing further evidence of the predominance of compressional tectonics in the evolution of the region. Expanding reflection spreads and a three-dimensional refraction survey have added fine details to the results in regions of special geological interest. An expanding reflection spread recorded in the northern part of the Amadeus Basin has enabled the resolution of complicated variations in seismic velocity throughout the 10 km thick sedimentary section, thus assisting lithological interpretation of the deeper formations, and enabling more accurate estimates of basin and formation thickness. Author

N91-27651# New South Wales Univ., Kensington (Australia). Dept. of Applied Geology.

GEOLOGICAL MAPPING IN THE CAMEL FLAT-ALLAMBI REGION OF THE AMADEUS BASIN WITH THE NS001 AIRBORNE SCANNER

G. R. Taylor and N. A. Moseley *In* Bureau of Mineral Resources, Geology and Geophysic Geological and Geophysical Studies in the Amadeus Basin, Central Australia, Bulletin 236 1991 p 59-6 Original contains color illustrations (For primary document see N91-27647 19-46)

Avail: Issuing Activity; 15 functional color pages

The NS001 scanner is the airborne prototype for the Landsat Satellite Thematic Mapper Scanner. The relevant imagery covers part of a swath of data collected over the Camel Flat-Allambi region of the Amadeus Basin. Radiometer-derived field spectra show several distinguishing features in siliciclastic and carbonate rocks, although those in the 2.2 micron wavelength band (band 7) cannot be separately discriminated because of the broad nature of the band. Correction of the scanner data for albedo and aspect illumination effects facilitates the extraction of spectral curves for particular terrain types and is essential for the effective analysis of spectral signatures. Principal component analysis of the uncorrected data creates components equivalent to the responses of scene albedo, surface roughness, vegetation cover, and soil proportion. A color composite image comprising the surface roughness, vegetation, and soil components enables the discrimination of a wide range of lithologies. True spectral features can be identified by the use of interband ratios. The choice of band ratios employing bands at adjacent, or near, wavelengths minimizes the surface roughness due to atmospheric scatter. Subtle variations in carbonate mineralogy and content can be identified from this image. Author

N91-27652# Bureau of Mineral Resources, Geology and Geophysics, Canberra (Australia).

SEISMIC VELOCITIES IN THE MISSIONARY PLAIN REGION: AN AID TO STRATIGRAPHIC STUDIES

C. Wright, T. Barton, B. R. Goleby, and F. J. Taylor *In its* Geological and Geophysical Studies in the Amadeus Basin, Central Australia, Bulletin 236 1991 p 67-72 (For primary document

see N91-27647 19-46)
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An expanding reflection spread with a maximum shot-receiver offset of 25 km was recorded in the Missionary Plain region to obtain seismic velocity estimates throughout the crust. Although there are lateral variations in seismic velocities and a small northerly dip of the sedimentary rocks, useful average interval velocities for each sedimentary formation were derived from measured reflection times. Below depths of 3 km, these interval velocities are a significant improvement on those obtainable from industry or Bureau of Mineral Resources (BMR) near-vertical incidence reflection data. The results enable more reliable estimates of the thickness of the deeper sedimentary formations to be derived. Refracted arrivals from the expanding spread were used to define seismic velocities at depths less than 1.5 km where there are few clear reflectors. Author

N91-27653# Magellan Petroleum Australia Ltd., Brisbane.
SEDIMENTATION AND TECTONICS IN THE NORTHEASTERN AND CENTRAL AMADEUS BASIN, CENTRAL AUSTRALIA
Robert Q. Oaks, Jr., James A. Deckelman, K. T. Conrad, L. P. Hamp, J. O. Phillips, and A. J. Stewart (Bureau of Mineral Resources, Geology and Geophysics, Canberra, Australia) *In* Bureau of Mineral Resources, Geology and Geophysic Geological and Geophysical Studies in the Amadeus Basin, Central Australia, Bulletin 236 1991 p 73-9 (For primary document see N91-27647 19-46)
Avail: Issuing Activity; 15 functional color pages

Sedimentation in the Amadeus Basin of central Australia took place between about 900 and 350 Ma, but was frequently interrupted by tectonic disturbances. These ranged in intensity from epeirogenic uplift and erosion to strong folding and formation of basin-wide unconformities. A latitudinal Central Ridge, about 400 km long, formed early in the history of the basin, during the Late Proterozoic, and divided the basin into northern and southern sub-basins. The geometry of the ridge is uncertain, but magnetic data suggest that it is a basement horst or thrust block overlain by the lower part of the basin sequence. Flowage of salt from low in the basin sequence formed anticlines and diapirs in the overlying Proterozoic sedimentary rocks, and salt may have moved up the flanks of the Central Ridge, accentuating its relief and forming depocentres in the northern and southern sub-basins. The Central Ridge provided a variety of traps (especially pinchouts) for hydrocarbons migrating from the nearby depocentres. Author

N91-27654# Bureau of Mineral Resources, Geology and Geophysics, Canberra (Australia).
NEW EVIDENCE FOR ANCIENT METAZOAN LIFE IN THE LATE PROTEROZOIC HEAVITREE, AMADEUS BASIN, CENTRAL AUSTRALIA
John F. Lindsay *In its* Geological and Geophysical Studies in the Amadeus Basin, Central Australia, Bulletin 236 1991 p 91-95 (For primary document see N91-27647 19-46)
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Burrow-like structures preserved in the Late Proterozoic (850 to 800 Ma) Heavitree Quartzite in the Amadeus Basin of central Australia appear to be of metazoan orgin. The burrows, some of which are similar to Skolithos, occur in tidal sandstones 80 m above the base of the formation. The only alternative explanation for the orgin of the structures is that they could result from soft-sediment deformation such as water-escape structures or sandstone dykes. Evidence of soft-sediment deformation is rare in the Heavitree Quartzite and, unlike such sedimentary structures, the boundaries of the burrows are sharply defined and there is no deformation of the enclosing sediments. If organic in origin, these structures are among the world's earliest traces of metazoan life. They lie stratigraphically more than 3000 m below the Ediacaran fauna of the Arumbera Sandstone and were formed at least 200 million years earlier. The discovery suggests that more attention needs to be given to Late Proterozoic rocks for signs of metazoan life, and that is should be focused on rocks with tidal or shallow-marine facies associations. Author

N91-27655# Bureau of Mineral Resources, Geology and Geophysics, Canberra (Australia).
LATE PROTEROZOIC AND EARLY PALAEOZOIC PALAEONTOLOGY AND BIOSTRATIGRAPHY OF THE AMADEUS BASIN
J. H. Shergold, Robyn Elphinstone, J. R. Laurie, Robert S. Nicoll, M. R. Walter, G. C. Young, and Wenlong Zang (Australian National Univ., Canberra.) *In its* Geological and Geophysical Studies in the Amadeus Basin, Central Australia, Bulletin 236 1991 p 97-111 (For primary document see N91-27647 19-46)
Avail: Issuing Activity; 15 functional color pages

The extent of palaeontological and biostratigraphic research undertaken during the most recent phase of Bureau of Mineral Resources (BMR) activity in the Amadeus Basin. Coordinated individual contributions are presented on the basis of the systematic palaeontological description and evaluation of the Late Proterozoic acritarchs, Early Cambrian inchofossils, Early Cambrian phosphatic and phosphatized macrofaunas, Late Cambrian and Early Orovician trilobites and condonts, and Ordovician and Devonian macro- and micro-vertebrates. As a result, biostratigraphic refinement of the Late Proterozoic-Early Cambrian Late Cambrian-Early Ordovician, and Middle-Late Devonian intervals was made possible, and represents a significant advance of knowledge. Refinement of the Late Cambrian-Early Ordovician interval has led to the recognition of previously unknown stratigraphic breaks of consequence to event stratigraphy and to the development of palaeogeographic models which have a wider application in other Australian cratonic basins. Author

N91-27656# Bureau of Mineral Resources, Geology and Geophysics, Canberra (Australia).
A SEDIMENTOLOGICAL MODEL FOR THE LOVES CREEK MEMBER OF THE BITTER SPRINGS FORMATION, NORTHERN AMADEUS BASIN
P. N. Southgate *In its* Geological and Geophysical Studies in the Amadeus Basin, Central Australia, Bulletin 236 1991 p 113-126 (For primary document see N91-27647 19-46)
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Sediments of the Loves Creek Member of the Bitter Springs Formation comprise the transgressive and highstand systems tracts of a stratigraphic sequence. The member is bounded top and bottom by disconformity surfaces and is divisible into three sedimentary packages referred to as units. Each unit represents a series of depositional environments related to each other by position on a large-scale sea-level cycle. The uppermost redbed and dolomitic limestone/dolostone unit provides evidence for continued regression and progradation as the underlying marine sediments are succeeded by carbonate rocks and redbeds deposited in lacustrine and terrestrial environments respectively. Author

N91-27657# Bureau of Mineral Resources, Geology and Geophysics, Canberra (Australia).
PARALIC AND PERIGLACIAL FACIES AND CONTEMPORANEOUS DEFORMATION OF THE LATE PROTEROZOIC OLYMPIC FORMATION, PIONEER SANDSTONE, AND GAYLAD SANDSTONE, AMADEUS BASIN, CENTRAL AUSTRALIA
B. D. Field *In its* Geological and Geophysical Studies in the Amadeus Basin, Central Australia, Bulletin 236 1991 p 127-136 (For primary document see N91-27647 19-46)
Avail: Issuing Activity; 15 functional color pages

The Olympic Formation is a Lake Proterozoic unit of basinal mudstone, shallow marine to fluvial sandstone and conglomerate deposited in the Amadeus Basin east of Alice Springs. Dropstones associated with the conglomerate indicate glacial activity of Marinoan age, although there is no evidence of a continental ice sheet covering the area at that time. Palaeocurrent directions suggests highs in the south and northeast. The Gaylad Sandstone is locally conformable on the Olympic Formation, although generally the formations are separated by an angular unconformity that records part of the Souths Range Orogeny. Deformation continued during deposition of the Gaylad Sandstone, and an intra-Gaylad

angular unconformity developed. Correlation of the Pioneer Sandstone and the Olympic Formation appears to rely heavily on correlation of the dolomite at Ellery Creek with that in the Olympic Formation. Author

N91-27658# Geological Survey of Western Australia, Perth.
STRATIGRAPHY OF THE LATE PROTEROZOIC GAYLAD SANDSTONE, NORTHEASTERN AMADEUS BASIN, AND RECOGNITION OF AN UNDERLYING REGIONAL UNCONFORMITY
M. J. Freeman, Robert Q. Oaks, Jr., and Russell D. Shaw (Bureau of Mineral Resources, Geology and Geophysics, Canberra, Australia) *In* Bureau of Mineral Resources, Geology and Geophysic Geological and Geophysical Studies in the Amadeus Basin, Central Australia, Bulletin 236 1991 p 137-154 (For primary document see N91-27647 19-46)
Avail: Issuing Activity; 15 functional color pages

Detailed mapping of Late Proterozoic units within cover napples in the northeast Amadeus Basin led to recognition of a new formation. The Gaylad Sandstone is defined and described, and its stratigraphic relations are documented. The formation completely underlies the Pertatataka Formation. Previously the Gaylad Sandstone was correlated with the Pioneer Sandstone and the Olympic Formation. However, the Gaylad Sandstone is lithologically distinct from those units, and it overlies a regional unconformity above them. This regional unconformity is correlated with a proposed diachronous unconformity at the base of the Pertatataka Formation in the central-north of the Amadeus Basin; with a widespread angular unconformity below the Winnall beds in the south of the Amadeus Basin; and with a widespread unconformity at the base of the Mopunga Group in the southwest Georgina Basin. Author

N91-27659# Bureau of Mineral Resources, Geology and Geophysics, Canberra (Australia).
THE PALAEOZOIC PALAEOGEOGRAPHY OF THE AMADEUS BASIN REGION
A. M. Walley, comp., P. J. Cook, comp., J. Bradshaw, A. T. Brakel, J. M. Kennard, John F. Lindsay, Robert S. Nicoll, S. Olissoff, M. Owen, and J. H. Shergold et al *In its* Geological and Geophysical Studies in the Amadeus Basin, Central Australia, Bulletin 236 1991 p 155-169 Original contains color illustrations (For primary document see N91-27647 19-46)
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The presented maps of the Amadeus Basin region form part of the Australian Palaeogeographic Maps Project. During this project, 79 continent-wide time slice maps were prepared, representing the palaeogeography of the entire Phanerozoic. Portions of selected maps were chosen to display the Palaeozoic evolution of the Amadeus Basin and surrounding region. Some of the time slices and map portions were updated to incorporate the more recent data reported. Author

N91-27660# Bureau of Mineral Resources, Geology and Geophysics, Canberra (Australia).
SEQUENCE STRATIGRAPHY OF THE LATEST PROTEROZOIC-CAMBRIAN PERTAOORRTA GROUP, NORTHERN AMADEUS BASIN, CENTRAL AUSTRALIA
J. M. Kennard and John F. Lindsay *In its* Geological and Geophysical Studies in the Amadeus Basin, Central Australia, Bulletin 236 1991 p 171-194 Original contains color illustrations (For primary document see N91-27647 19-46)
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Sequence stratigraphic concepts are used to identify and analyze five major depositional sequences in the latest Proterozoic-Cambrian Pertaoorta Group. This analysis is based largely on the recognition of facies discontinuities and biostratigraphic hiatuses in field outcrops and well-logs, and is integrated with seismic data. This alternative approach to sequence analysis is necessitated by the essentially layer-cake pattern of seismic reflections a scarcity of seismically defined terminations within intracratonic strata. Author

N91-27661# Bureau of Mineral Resources, Geology and Geophysics, Canberra (Australia).
LOWER CAMBRIAN ARCHAEOCYATHAN BUILDUPS, TODD RIVER DOLOMITE, NORTHEAST AMADEUS BASIN, CENTRAL AUSTRALIA: SEDIMENTOLOGY AND DIAGENESIS
J. M. Kennard *In its* Geological and Geophysical Studies in the Amadeus Basin, Central Australia, Bulletin 236 1991 p 195-225 Original contains color illustrations (For primary document see N91-27647 19-46)
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Two distinct types of archaeocyathan buildups occur within the Lower Cambrian Todd River Dolomite: a high energy, intermittently emergent, bioherm and grainstone reef-shoal, and low energy open-shelf bioherms and patch reefs. The primary fabric of these buildups was largely destroyed by dolomitisation. Facies relationship indicate that high and low energy buildups are temporal equivalents, and that the high energy reef-shoal now present in the N'Dhala Thrust Sheet was flanked to the east and south by a low energy shelf studded with bioherms and patch reefs. The reef-shoal was capped locally by microbial mudflats. Author

N91-27662# Bureau of Mineral Resources, Geology and Geophysics, Canberra (Australia).
DESCRIPTION AND DEPOSITIONAL MODEL OF THE CHANDLER FORMATION: A LOWER CAMBRIAN EVAPORITE AND CARBONATE SEQUENCE, AMADEUS BASIN, CENTRAL AUSTRALIA
J. Bradshaw *In its* Geological and Geophysical Studies in the Amadeus Basin, Central Australia, Bulletin 236 1991 p 227-244 Sponsored in part by Magellan Petroleum Australia Ltd. (For primary document see N91-27647 19-46)
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The Chandler Formation is a Lower Cambrian carbonate and evaaporite sequence in the Amadeus Basin, central Australia. The carbonate is widely distributed but thin, and is organic-rich, foetid, carbonate mudstone. The carbonate is dolomitized where associated with evaporites. The thick evaporite is almost totally composed of halite, and has bromine profiles suggesting a marine source. The depositional model proposed for the Chandler Formation is a shallow water, deep desiccated basin, analogous to the Messinian evaporites of the Mediterranean region. The carbonate and evaporite deposits represent distinct depositional phases in the evolution of the Chandler Formation, and three stages are recognized: desiccation and evaporite precipitation; basin flooding and carbonate deposition; and karstification and evaporite precipitation. Author

N91-27663# Bureau of Mineral Resources, Geology and Geophysics, Canberra (Australia).
THE TEMPE FORMATION: AN EARLY MIDDLE CAMBRIAN, OPEN MARINE, CLASTIC, AND CARBONATE SEQUENCE, CENTRAL AMADEUS BASIN
J. Bradshaw *In its* Geological and Geophysical Studies in the Amadeus Basin, Central Australia, Bulletin 236 1991 p 245-252 (For primary document see N91-27647 19-46)
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The Tempe Formation is an early Middle Cambrian clastic and carbonate sequence that occurs in the central part of the Amadeus Basin, central Australia. Shale and siltstone are the dominant clastic components throughout, with relatively minor amounts of sandstone concentrated towards the base. Near the top of the formation, an interval of skeletal (phosphatic) carbonate occurs. The facies recognized include bay, lagoon, tidal flat, upper shoreface, lower shoreface and offshore. The offshore facies thickens from east to west, the shoreface facies thickens from north to south, and the bay, lagoon, and tidal flat facies are evenly distributed. Author

N91-27664# Petroz N.L., Perth (Australia).
PALAEOGEOGRAPHY OF LATE CAMBRIAN TO EARLY ORDOVICIAN SEDIMENTS IN THE AMADEUS BASIN, CENTRAL AUSTRALIA
John D. Gorter *In* Bureau of Mineral Resources, Geology and Geophysic Geological and Geophysical Studies in the Amadeus

Basin, Central Australia, Bulletin 236 1991 p 253-275 (For primary document see N91-27647 19-46)
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The depositional history of 6 sequences encompassing 18 parasequence of the Late Cambrian to Early Ordovician age in the Amadeus Basin is presented in a seried of generalized paleogeographic maps. As some of the parasequence sets are known to host large deposits of oil and gas, a thorough understanding of the potential reservoir-source rock combinations in the Amadeus Basin is essential for the discovery of further oil and gas reserves in this vast, under-explored basin. The best reservoir rocks in the Pacoota Sandstone are concentrated above the major sequence boundary between the Wallaby and Tempe Vale sequences on the Central Ridge. Poorer reservoirs occur within other sequences (e.g., parasequence set 3 and 13). Parasequence set 3 reservoirs, localized on the Central Ridge, are generally poor but owe their reservoir character to weathering at the pre-Tempe Vale sequence unconformity. Parasequence set 13 reservoirs are also concenterated along the Central Ridge, where small-scale shoaling clastic cycles are better developed. Basal Stairway Sandstone reservoirs in the Mereenie area on the Central Ridge are generally very poor, due to the cementation of the clean sandstone, but should improve to the southwest due to lesser burial-induced silicification. The source potential of the major Arenig organic-rich sediments is concentrated in the transitional zone between parasequence sets 15 and 16. East of West Waterhouse 1 well, these parasequence sets have been eroded and there is no remaining source potential. The transitional source-rich zone is better developed on the Central Ridge than in the Missionary Plain Trough. The Central Ridge is therefore of prime importance in the localization of both reservoir and source rocks in the Late Cambrian and Early Ordovician section of the Amadeus Basin. Author

N91-27665# Bureau of Mineral Resources, Geology and Geophysics, Canberra (Australia).
ORDOVICIAN SEDIMENTS IN THE WATERHOUSE RANGE ANTICLINE, AMADEUS BASIN, CENTRAL AUSTRALIA: THEIR INTERPRETATION AND TECTONIC IMPLICATIONS
Robert S. Nicoll, John D. Gorter (Petroz N.L., Perth, Australia), and M. Owen *In its* Geological and Geophysical Studies in the Amadeus Basin, Central Australia, Bulletin 236 1991 p 277-284 (For primary document see N91-27647 19-46)
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Examination of stratigraphic sections of Ordovician sediments in the Waterhouse Range Anticline and adjacent areas of the Amadeus Basin, central Australia, indicate that the geologic history of the region is much more complex than suggested in earlier studies. Unconformities are identified between the Pacoota Sandstone and the Horn Valley Siltstone, between the Horn Valley Siltstone and the Stairway Sandstone, and between the Stairway Sandstone and the Mereenie Sandstone, and are related to the Kelly Creek Eustatic Event, the Maloney Creek Eustatic Event (new name), and the Rodingan Movement, respectively. The lateral trunction of some of these formations onto the anticline indicates that the Waterhouse Range may have been an active growth structure in Ordovician time, probably driven by salt tectonics. Author

N91-27666# Magellan Petroleum Australia Ltd., Brisbane.
RECOGNITION OF A FLUVIAL FACIES IN THE PACOOTA SANDSTONE AND ITS IMPLICATIONS FOR PETROLEUM EXPLORATION
James A. Deckelman *In* Bureau of Mineral Resources, Geology and Geophysic Geological and Geophysical Studies in the Amadeus Basin, Central Australia, Bulletin 236 1991 p 285-301 (For primary document see N91-27647 19-46)
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A previously unrecognized fluvial facies is present in the Late Cambrian-Early Ordovician Pacoota Sandstone in the north-central and northwestern parts of the Amadeus Basin. This facies forms the base of the P3 unit and correlates directly with the primary oil and gas producing interval in the Pacoota Sandstone at the Mereenie Field. In order to distinguish this facies from overlying facies in the P3, it is proposed that the P3 be divided into a lower dominantly fluvial unit, the P3B, and an upper estuarine and shoreface unit, the P3A. Both units can be mapped for hundreds of kilometers at the surface and in the subsurface throughout the Mereenie Field and adjacent areas. The P3B is interpreted as a deposit that accumulated in a dominantly fluvial environment on the basis of: its locally erosional lower bounding surface; the absence of body fossils and ichnofossils; the lobate, wedge-shaped geometry of the unit; the subarkosic composition of the sandstone; the presence of pebble and cobble conflomerate; abundant early syngenetic hematite; abundant trough cross-sets up to 1.35 m thick; overturned cross-laminae; relatively abundant asymmetrical ripple marks; contorted stratification; beds in excess of 1 m in thickness; and its unimodal paleocurrent distribution. The P3B grades conformably into overlying estuarine and shoreface sediments of the P3A. Anagentic silicification is the most significant diagenetic event affecting the present lateral distribution of primary porosity in the P3B unit. Because the extent of anagenetic silificiation decreases southward, the potential for preservation of primary porosity is greatest near the southern depositional limit of the unit. Secondary porosity in the P3B formed by the dissolution of feldspar. Because the abundance of feldspar is inversely related to grainsize which decreases to the southeast, the potential for development of secondary porosity is greatest near the southeastern depositional limit of the unit. Author

N91-27667# Petroz N.L., Perth (Australia).
OOLITIC AND PISOLITIC IRONSTONES IN THE EARLY ORDOVICIAN (ARENIG) OF THE AMADEUS BASIN, CENTRAL AUSTRALIA
John D. Gorter *In* Bureau of Mineral Resources, Geology and Geophysic Geological and Geophysical Studies in the Amadeus Basin, Central Australia, Bulletin 236 1991 p 303-315 (For primary document see N91-27647 19-46)
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Early Ordovician oolitic ironstone was first reported from the subsurface Pacoota Sandstone of the Amadeus Basin in the Tempe Vale 1 petroleum exploration well in 1982, and found subsequently in Tent Hill 1 and Mt Winter 2 coreholes. Density log correlations and descriptions of cuttings show the presence of ironstones in other wells in the northwestern part of the basin. Several measured sections in the same general area also contain discrete beds of oolitic or pisolitic ironstone. All known occurrences are in the Early Arenig upper Pacoota Sandstone. Two types of deposition are apparent: Type 1 oolitic ironstones gradationally overlie a shallowing-upward marine clastic cycle, commencing with deeper water shales and passing upward through bioturbated siltstones to cross-bedded sandstones, and terminating in bioturbated oolitic ironstones; and Type 2 oolitic ironstones are invariably sharply bounded, non-bioturbated, generally structureless but sometimes cross-bedded, occur interbedded with marine clastics, and do not always occur at the top of shallowing-upward cycles. Type 1 oolithic ironstones are interpreted to have been deposited in-situ upon shoaling barrier bars in a low energy, shallow intracratonic sea. Type 2 ironstones are interpreted to have been reworked from the tops of such barrier bars, possibly during storms, and redeposited in offshore to lower shoreface environments. Author

N91-27668# Bureau of Mineral Resources, Geology and Geophysics, Canberra (Australia).
AS THE WORM TURNS: IMPLICATIONS OF BIOTURBATION ON SOURCE ROCKS OF THE HORN VALLEY SILTSTONE
Robyn Elphinstone and John D. Gorter (Petroz N.L., Perth, Australia) *In its* Geological and Geophysical Studies in the Amadeus Basin, Central Australia, Bulletin 236 1991 p 317-332 (For primary document see N91-27647 19-46)
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The Horn Valley Siltstone was subdivided into ten informal members, HV1 (lowermost) to HV10, which reflect vertical lithofacies variations in a shallow marine shelf environment. The members were defined primarily from fully cored wells combined with gamma ray, sonic and density logs. Sedimentological and

paleontological information, such as the presence or absence of body fossils, mode of preservation, species associations within groups of fossils, presence or absence of bioturbation (trace fossils), lithology, and bedding type, were also used. It can be inferred that the amount and composition of organic matter preserved in the sediment was determined largely by the concentration of oxygen in the bottom water and the extent to which the sediment was disrupted by burrowing organisms, because burrowing and scavenging activities of benthic organisms are controlled by the concentration of oxygen in the bottom water. Organic geochemical data from Tempe Vale 1 and Tent Hill 1 were used to confirm these facies variations. The Horn Valley Siltstone was deposited during a transgressive-regressive episode and the organic-rich sediments, those with high TOC values (HV5, HV6, HV7), were buried rapidly. This allowed the exceptional preservation of organic matter and reduced its residence time in zones of bioturbation and oxic decomposition. This may have been linked to upwelling along the Central Ridge. The bioclastic limestone and dolomite interbedded with the bioturbated shale and siltstone (e.g., HV3, HV9) were probably deposited within well oxygenated and shallower shelf settings, and were moved by density currents into deeper water. Author

N91-27669# Wollongong Univ. (Australia). Dept. of Geology.
FLUVIAL AND LACUSTRINE FACIES IN THE MIDDLE TO LATE DEVONIAN PERTNJARA GROUP, AMADEUS BASIN, NORTHERN TERRITORY, AND THEIR RELATIONSHIP TO TECTONIC EVENTS AND CLIMATE

B. G. Jones *In* Bureau of Mineral Resources, Geology and Geophysic Geological and Geophysical Studies in the Amadeus Basin, Central Australia, Bulletin 236 1991 p 333-348 Sponsored in part by Australian National Univ., Uranerz (Australia) Pty. Ltd.; and Agip Australia Pty. Ltd. (For primary document see N91-27647 19-46)

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The distribution, grainsize and facies variations in the Middle to Late Devonian Pertnjara Group, Amadeus Basin, can be directly related to tectonic events which formed and deformed the basin during sedimentation. The Pertnjara Group consists of a series of lacustrine, braided and meandering fluviatile and alluvial fan deposits which accumulated as a southward thinning wedge in the Amadeus Basin during successive pulses of the Alice Springs Orogeny. Sedimentation of the group started during a pluvial quiescent period following the Late Ordovician Rodingan Movement and deposition of the aeolian Mereenie Sandstone. An uplift event (Pertnjara Movement) in the late Givetian or early Frasnian produced the first wedge of fluviatile sandstone which accumulated in the rapidly subsiding north-central Amadeus Basin (Carmichael Sub-basin). At the same time, thinner sequences of fluvial and aeolian sandstone were accumulating in the eastern part of the Amadeus Basin. The following quiescent phase was characterized by the deposition of playa-lake siltstone in the center of the Amadeus Basin under semi-arid or arid conditions. Gentle uplift north of the basin during the Frasnian Henbury Movement resulted in widespreas deposition of the fluviatile, lower Hermannsburg Sandstone. The rate of uplift increased rapidly during the succeeding late Frasnian to early Famennian Brewer Movement and was probably concentrated along the Redbank Deformed Zone close to the present northern margin of the basin. A thick wedge of Brewer Conglomerate accumulated contemporaneously in the rapidly downwarping Missionary Plain Trough and Carmichael Sub-basin and records a return to plubial conditions with abundant organic matter being preserved. Growth structures within the basin record movement during some of these tectonic events and help to define the areas affected at each stage. Rank studies on organic material confirm the sedimentological data and also indicate that at least 1 to 2 km of younger strata must have been removed from the northern part of the basin. These deposits probably reflect the Carboniferous and possibly Early Permian uplift events in the Arunta Block indicated by radiometric and fission track studies. The main folding of the Pertnjara sequence occurred during one of these later pulses of the Alice Springs Orogeny. Author

N91-27670# MacQuarie Univ., North Ryde (Australia). Plate Research Group.
NEW PALAEOMAGNETIC RESULTS FROM THE AMADEUS BASIN AND THEIR IMPLICATIONS FOR STRATIGRAPHY AND TECTONICS

Z. X. Li, C. M. Powell, B. J. J. Embleton, and P. W. Schmidt (Commonwealth Scientific and Industrial Research Organization, North Ryde, Australia) *In* Bureau of Mineral Resources, Geology and Geophysic Geological and Geophysical Studies in the Amadeus Basin, Central Australia, Bulletin 236 1991 p 349-360 Sponsored in part by ARGC and Commonwealth Scientific and Industrial Research Organization (For primary document see N91-27647 19-46)

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A new palaeomagnetic study of the Mereenie Sandstone reveals a remanence direction different from the previously published result. The palaeopoles obtained from this formation and the overlying Devonian rock formations link with the existing palaeopoles from both the Lachlan fold Belt (LFB) and cratonic Australia and form a single mid-late Palaeozoic apparent polar wander path (APWP) for Australia. This study suggests that the LFB has been joined to a cratonic Australia since at least Devonian times. The palaeomagnetic results suggest that the Mereenie Sandstone is probably of mostly Silurian age and that the Parke Siltstone and Hermannsburg Sandstone (including the Ooraminna Sandstone Member in the Ross River Syncline) are of Mid-Devonian age, results which are consistent with palaeontological discoveries in the Pertnjara Group. These results also suggest that Australia occupied low palaeolatitudes through the mid-Palaeozoic. Poorly defined but widespread Late Palaeozoic magnetic overprints were observed. They suggest that for most of the Amadeus Basin region, the main phase of folding occurred during the Middle or Late Carboniferous, which could have been the peak of the Alice Springs Orogeny. Results from the Waterhouse Anticline indicate that it could have formed earlier, soon after the deposition of the mid-Devonian Hermannsburg Sandstone. Author

N91-27671# Bureau of Mineral Resources, Geology and Geophysics, Canberra (Australia).
MESOTHRUST VERSUS MEGATHURST INTERPRETATIONS OF THE STRUCTURE OF THE NORTHEASTERN AMADEUS BASIN, CENTRAL AUSTRALIA

A. J. Stewart, Robert Q. Oaks, Jr., James A. Deckelman (Magellan Petroleum Australia Ltd., Brisbane.), and Russell D. Shaw *In its* Geological and Geophysical Studies in the Amadeus Basin, Central Australia, Bulletin 236 1991 p 361-383 (For primary document see N91-27647 19-46)

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The Amadeus Basin is an intracratonic sag filled with Late Proterozoic to Devonian shallow marine to terrestrial sediments. It is part of an Australia wide zone that was tectonically active between 2000 and 350 Ma. Decollement sliding on two major evaporite horizons in the sequence formed large allochthonous thrust sheets. Two interpretations of the structure are proposed. The mesothrust interpretation (Oaks and Deckelman) proposes that the northeastern Amadeus Basin comprises two continuous large thrust sheets. The megathrust interpretation (Stewart and Shaw) regards the segment forming the center and southwest of Oaks and Deckelman's southward gliding sheet as parautochthon, and the remaining sheets as remnants of a large nappe. Restored sections in the megathrust interpretation show the major detachment fault ramping upsection in the east where a lens of dominantly terrigenous clastics enclosed in shale, thinned southward. The megathrust interpretation predicts large areas of concealed Proterozoic-Cambrian sandstones prospective for hydrocarbons beneath the exposed allochthonous strata north of the Central Ridge in the eastern part of the area. Tectonism was coeval with orogeny in eastern Australia. Author

N91-27672# Bureau of Mineral Resources, Geology and Geophysics, Canberra (Australia).

SEISMIC INTERPRETATION AND THRUST TECTONICS OF THE AMADEUS BASIN, CENTRAL AUSTRALIA, ALONG THE BMR REGIONAL SEISMIC LINE

Russell D. Shaw, Russell J. Korsch, C. Wright, and B. R. Goleby *In its* Geological and Geophysical Studies in the Amadeus Basin, Central Australia, Bulletin 236 1991 p 385-408 (For primary document see N91-27647 19-46)

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At the northern margin of the Amadeus Basin the monoclinal upturn (the MacDonnell Homocline) is interpreted to be the result of rotation and limited back-thrusting of the sedimentary sequence in front of a southerly-directed, imbricate basement thrust-wedge. This thrust complex is linked at depth to the crust-cutting Redbank Thrust Zone. In the northern part of the basin immediately to the south, regional seismic reflection profiling across the Missionary Plain shows a sub-horizontal, north-dipping, parautochthonous sedimentary sequence between about 8.5 km and 12.0 km thick. This sedimentary sequence shows upturning only at the northern and southern extremities, and represents an unusual, relatively undeformed region between converging thrust systems. In this intervening region, the crust appears to have been tilted downwards and northwards in response to the upthrusting to the north. Still farther to the south, the vertical uplift of the southern hanging wall of the Gardiner Thrust is about 6 km. Seismic reflection profiling in the region immediately south of the Gardiner Thrust indicates repetition of the sedimentary sequence. At the far end of the profile, in the Kernot Range, an imbricate thrust system fans ahead of a ramp-flat thrust pair. This thrust system (the Kernot Range Thrust System) occurs immediately north of an aeromagnetic domain boundary which marks the southern limit of a central ridge region characterized by thin Palaeozoic sedimentary cover and shallow depths to magnetic basement. A planar seismic event, imaged to a depth of at least 18 km, may correspond to the same boundary and is interpreted as a pre-basin Proterozoic thrust. Overall, the structure in the shallow sedimentary section in the central-southern region of the Amadeus Basin indicates that north-directed thrusting during the Dovonian-Carboniferous Alice Springs Orogeny was thin-skinned. During this orogeny an earlier thrust system, formed during the Petermann Ranges Orogeny and precursor orogenies in the Late Proterozoic, was reactivated with Proterozoic salt deposits localising the decollement zone. The Alice Springs Orogeny also reactivated a major mid Proterozoic province boundary in the basement to the north of the basin, resulting in major thrust movement at the northern basin margin. Author

N91-27673# Australian National Univ., Canberra. Research School of Earth Sciences.

TELESEISMIC TRAVEL-TIME ANOMALIES AND DEEP CRUSTAL STRUCTURE OF THE NORTHERN AND SOUTHERN MARGINS OF THE AMADEUS BASIN

K. Lambeck *In* Bureau of Mineral Resources, Geology and Geophysic Geological and Geophysical Studies in the Amadeus Basin, Central Australia, Bulletin 236 1991 p 409-427 (For primary document see N91-27647 19-46)

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Teleseismic travel-times recorded across the central Australian basins and Musgrave and Arunta Blocks impose significant constraints on crustal and upper mantle structure. Major discontinuities in lateral structure are required, particularly across the Redbank-Ormiston Thrusts in the Arunta Block and the Woodroffe-Mann Thrusts in the Musgrave Block. The deep structure of these tectonic units exhibit considerable similarity, and in both instances the thrusts dip at about 45 degrees through to the Moho. Major offsets in Moho depth are produced which have persisted since the time of the last movements on the faults, about 300 Ma ago in the case of the Redbank Thrust and much earlier in the case of the Woodroffe-Mann Thrusts. The teleseismic models are consistent with deep crustal seismic reflection observations across the Redbank Thrust Zone, and they confirm the conclusion drawn from gravity studies that the region as a whole is not in local isostatic equilibrium and that maximum stress-differences within the crust and upper mantle are of the order of 100 MPa. Author

N91-27674# Bureau of Mineral Resources, Geology and Geophysics, Canberra (Australia).

THE TECTONIC DEVELOPMENT OF THE AMADEUS BASIN, CENTRAL AUSTRALIA

Russell D. Shaw *In its* Geological and Geophysical Studies in the Amadeus Basin, Central Australia, Bulletin 236 1991 p 429-461 (For primary document see N91-27647 19-46)

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The Amadeus Basin is a Late Proterozoic to early Phanerozoic basin in central Australia, in which at least nine tectono-stratigraphic intervals (megasequences) are recognized, separated by regional unconformities. A major change in basin shape characterizes each interval. Although plausible basin-forming mechanisms can be suggested for each interval, the dominant mechanism is not always clear in each case. Tectono-thermal processes, not necessarily related to rifting, may be applicable to the initiation of subsidence within the basin during interval 1 (Heavitree Quartzite-Bitter Springs Formation). A modification of the contractional tilted-fault block model may be an appropriate explanation for the basin shape in the early stages of intervals 2 and 3 (Areyonga Formation to Julie Formation). However, increased subsidence in the later stages of intervals 2 and 3 may relate to a drop in the regional stress. Extensional tectonism may explain depositional patterns established during interval 4 (Arumbera Sandstone and Todd River Dolomite). Accommodation zones dividing depositional compartments in the north of the basin are interpreted as transfer faults. The extrusion of plateau basalts at province boundaries surrounding the central Australian region may correspond to the culmination of deep-seated lithospheric extension. The widespread subsidence which started gradually with the onset of interval 5 (Chandler Formation to lower Goyder Formation) is interpreted to correspond to the beginning of a thermal relaxation phase following the end of the lithospheric thinning and continental break-up. A two-layer extension model is invoked to explain subsidence during intervals 4 and 5. It is proposed that extension was initially minimal and heterogeneously distributed. As the extension increased, it became progressively concentrated in the lower crust and lithospheric mantle due to an increasing ductility with depth. A mid-crustal detachment zone formed between a less extended upper crust and a more extended lower crust and mantle. This model can explain the lack of normal faulting during interval 4 and the widespread subsidence during interval 5. Inherited characteristics are considered to be particularly important to basin development during intervals 6, 7, and 8. Author

N91-27675# Magellan Petroleum Australia Ltd., Brisbane.

PETROLEUM EXPLORATION IN THE AMADEUS BASIN

L. E. Roe *In* Bureau of Mineral Resources, Geology and Geophysic Geological and Geophysical Studies in the Amadeus Basin, Central Australia, Bulletin 236 1991 p 463-476 (For primary document see N91-27647 19-46)

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Although the spectacular outcrops in the Amadeus Basin have attracted researcher for many years, commercial exploration for oil started only in 1958. Up until 1973, 16 petroleum exploration wells were drilled and the major Mereenie Oil and Gas Field and the Palm Valley Gas Field were discovered. In both cases, the principal reservoir is the latest Cambrian-Early Ordovician Pacoota Sandstone; the reservoirs were sourced from the Early Ordovician Horn Valley Siltstone. Due to a combination of adverse circumstances, there was no exploration in the basin between 1973 and 1980. Since activity resumed, 14 further exploratory wells have been drilled and both the Mereenie and Palm Valley Fields have commenced production. The Dingo Gas Field, with flows form the basal part of the latest Proterozoic Arumbera Sandstone, was discovered in 1981. The Dingo Field is currently under study because of low flow rates from the reservoir. Exploration during the 1980's has brought out new concepts regarding the prospectiveness of parts of the basin, many of which have yet to be tested. Author

N91-27676# Magellan Petroleum Australia Ltd., Brisbane.
THE PALM VALLEY GAS FIELD, AMADEUS BASIN, CENTRAL AUSTRALIA
R. F. DoRozario *In* Bureau of Mineral Resources, Geology and Geophysic Geological and Geophysical Studies in the Amadeus Basin, Central Australia, Bulletin 236 1991 p 477-492 (For primary document see N91-27647 19-46)
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The Palm Valley Gas Field is one of the more significant gas fields discovered in onshore Australia as it not only contains substantial proven reserves of natural gas, but also is the only field predominantly dependent on fractures for productivity. The field was discovered in March 1965 when Palm Valley 1 well flowed up to 11.7 million cubic feet of gas/day from Ordovician sandstones and carbonates. A further five wells have been drilled since that time, with a wide variation in gas flow rate, from a rate too small to measure to over 130 million cubic feet/day. Results from these wells and subsequent studies have demonstrated that high productivity is dependent on the intersection of zones of open fractures which, from limited data, appear to occur along or close to the anticline's axis. With the recent completion of gas pipelines to the cities of Alice Springs and Darwin, the field is now the major supplier of energy to the Northern Territory.
Author

N91-27677# AGL Petroleum Ltd., Brisbane (Australia).
MEREENIE OIL AND GAS FIELD, AMADEUS BASIN, NORTHERN TERRITORY
P. J. Havord *In* Bureau of Mineral Resources, Geology and Geophysic Geological and Geophysical Studies in the Amadeus Basin, Central Australia, Bulletin 236 1991 p 493-510 (For primary document see N91-27647 19-46)
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Deposition and structuring of the Amadeus basin's Proterozoic and Palaeozoic sequences have been influenced by several tectonic episodes ending in the Late Devonian Alice Springs Orogeny which produced the Mereenie Anticline. Detection of the exposed eastern half of the structure by aerial photography eventually led to drilling of the discovery well, Mereenie 1. One of a series of en-echelon structures, the Mereenie Anticline is bounded to the south by a large thrust fault, with the field situated on the upper plate of the thrust. Oil and gas occur within stacked marine to shoreline sands of the Late Cambrian to Early Ordovician Pacoota Sandstone and Middle Ordovician Stairway Sandstone. Oil has been sourced mainly from the Early Ordovician Horn Valley Siltstone and is of marine origin. Reservoir quality within the field has been severely impaired by diagenesis, particularly silicification. Almost all oil and gas production has been from quartz rich sands within the Pacoota Sandstone where porosity averages 8 pct. and permeability 10 md. Despite the low clay content of these sands, pore throat blockage by migration of fines is now known to be a major cause of formation damage at Mereenie. The presence of oil and gas below simple structural closure in some sands is accounted for by faulting and/or diagenetic permeability variations.
Author

N91-27678# Bureau of Mineral Resources, Geology and Geophysics, Canberra (Australia).
PETROLEUM SOURCE ROCKS OF THE AMADEUS BASIN
R. E. Summons and T. G. Powell *In its* Geological and Geophysical Studies in the Amadeus Basin, Central Australia, Bulletin 236 1991 p 511-524 (For primary document see N91-27647 19-46)
Avail: Issuing Activity; 15 functional color pages

Sediment cores from exploration and stratigraphic boreholes in the Amadeus Basin were examined for information about the distribution, quality and distinctiveness of source rock intervals. Significant intervals of mature and moderate to rich source rock were confined to one unit, the Ordovician Horn Valley Siltstone. Organic matter was present in the Cambrian Chandler Formation and in the Proterozoic Pertatataka and Bitter Springs Formations. In these older units, the abundance of kerogen was generally very low and restricted to narrow intervals, mostly within shale beds and where organic content rarely exceeded 1 percent. Low amounts of bitumens were widely distributed throughout the carbonates of the Proterozoic and these generally showed different compositions to bitumens extracted from the shales. Rock-Eval Pyrolysis and biomaker distributions suggest that the organic matter in the Cambrian and Proterozoic sediments, where it does exist, is mature with respect to petroleum generation. Distinctive hydrocarbon distributions of bitumens extracted from the Horn Valley Siltstone confirm that the organic matter partially originated from the remains of Gloeocapsomorpha prisca and that the oils of Mereenie and Palm Valley have been derived from this source. High temperature thresholds are probably necessary for hydrocarbon generation from the Ordovician kerogens of the Horn Valley Siltstone.
Author

N91-27679# Melbourne Univ., Parkville (Australia). Dept. of Geology.
APATITE FISSION TRACK ANALYSIS OF THE PACOOTA AND STAIRWAY SANDSTONES, AMADEUS BASIN, CENTRAL AUSTRALIA
P. R. Tingate *In* Bureau of Mineral Resources, Geology and Geophysic Geological and Geophysical Studies in the Amadeus Basin, Central Australia, Bulletin 236 1991 p 525-540 Sponsored in part by Australian Research Grants Scheme (For primary document see N91-27647 19-46)
Avail: Issuing Activity; 15 functional color pages

Apatite fission track analysis of outcrop samples from the Cambrian-Ordovician Pacoota and Stairway Sandstones from the Amadeus Basin show that all samples have experienced higher temperatures in the past. The youngest apatite fission track ages of around 200 Ma are found along the northern margin of the basin and along the trend of the Johnny Creek Anticline and Watson Range. These younger ages reflect total or near total annealing of tracks due to burial associated with the Alice Springs Orogeny. Outcrop samples with older fission track ages (250 to 650 Ma) elsewhere in the basin are consistent with partial overprinting by maximum palaeotemperatures of between 70 and 110 C. Confined track length data from these samples suggest that a protracted cooling due to uplift and erosion has occurred since the Alice Springs Orogeny. Totally reset apatite fission track ages occur at depths between 1 and 2 km in the Alice 1, Wallaby 1 and East Mereenie 2 wells. The geothermal gradients at the time of maximum palaeotemperature appear similar to those of the present day suggesting that thermal maturation of oil source rocks in the basin was due to heating associated with burial rather than increased heat flow during the Alice Springs Orogeny. The geological setting and thermal history of the basin is consistent with subsidence at the time of the Alice Springs Orogeny as the result of foreland loading.
Author

N91-27680# Bureau of Mineral Resources, Geology and Geophysics, Canberra (Australia).
REMOTE SENSING OF NATURAL HYDROCARBON SEEPAGE AT THE PALM VALLEY GAS FIELD, AMADEUS BASIN, CENTRAL AUSTRALIA **c43**
C. J. Simpson, J. R. Wilford, L. F. Macias, and Russell J. Korsch *In its* Geological and Geophysical Studies in the Amadeus Basin, Central Australia, Bulletin 236 1991 p 541-561 Original contains color illustrations (For primary document see N91-27647 19-46)
Avail: Issuing Activity; 15 functional color pages

Digital image processing of advanced aircraft and LANDSAT Thematic Mapper (TM) satellite remotely sensed data over sandstones of the Palm Valley Gas Field, central Australia, showed a distinct color anomaly about 6 km long by 1.5 km wide which is not obvious in visible wavelength imagery. Field inspection showed that the color anomaly was characterized by different rock-weathering color, a geobotanical anomaly, calcium carbonate precipitation within rock fractures, and different soil pH. Inorganic rock geochemistry indicates significant chemical differences in some major elements for some samples from within the anomaly. A limited number of soil gas samples were analysed and within the remotely sensed color anomaly some had above-threshold

concentrations of methane, ethane, propane and butane. Preliminary processing of airborne magnetic and gamma spectrometric data over the anticline did not indicate any significant values that suggest abnormal development of magnetite or clay minerals within the color anomaly. Carbon and oxygen isotope analyses of calcrete from within the color anomaly suggest, somewhat inconclusively, that hydrocarbons have not contributed significantly to the formation of the calcium carbonate component of the calcrete. Consideration of all available information suggests that the color anomaly detectable by aircraft and LANDSAT TM satellite remote sensing corresponds to a zone of surface alteration resulting from long-term seepage of hydrocarbon gases. This color anomaly, the first of its type reported from Australia, was detected because of spectral reflectance differences resulting from a combination of increased soil carbonate and different geobotanical characteristics from those of the surrounding terrain. Author

N91-27681# Lau (G. C. and J. E.) and Associates, Canberra (Australia).
AQUIFER CHARACTERISTICS AND GROUNDWATER RESOURCES OF THE AMADEUS BASIN **c43**
J. E. Lau and G. Jacobson (Bureau of Mineral Resources, Geology and Geophysics, Canberra, Australia) *In* Bureau of Mineral Resources, Geology and Geophysic Geological and Geophysical Studies in the Amadeus Basin, Central Australia, Bulletin 236 1991 p 563-579 Sponsored in part by Department of Primary Industries and Energy (For primary document see N91-27647 19-46)
Avail: Issuing Activity; 15 functional color pages

The Amadeus Basin contains important sandstone aquifers in its syncline fold belt, including the Mereenie Sandstone, Hermannsburg Sandstone and Pacoota Sandstone. In these three aquifers, ground water flow is generally eastward along syncline axes. In the south, fractured Proterozoic rocks are overlain by Cainozoic sediments and a two layered aquifer system discharges to a 500 km zone of salt lakes. The limiting factor to ground water development is salinity, although the high nitrate and fluoride content of some ground waters is also a constraint. Better quality ground waters have been explored at the synclinal margins, and, although these are palaeowaters, significant resources have been proved in parts of the basin. Modern ground water recharge occurs but is negligible in amount, and major ground water development will need to draw on stored palaeowaters. Resources of brackish ground water are substantial and can potentially be further exploited for livestock, irrigation and other uses. Hypersaline brines in the major ground water discharge zone in the south of the basin have economic potential as a source of industrial minerals.
Author

N91-27682# Bureau of Mineral Resources, Geology and Geophysics, Canberra (Australia).
CHEMICAL SEDIMENTATION AND FACIES RELATIONSHIPS IN THE KARINGA CREEK PALAEO-DRAINAGE SYSTEM, AMADEUS BASIN, NORTHERN TERRITORY
A. V. Arakel and G. A. Wakelin-King (Department of Mines and Energy, Alice Springs, Australia) *In its* Geological and Geophysical Studies in the Amadeus Basin, Central Australia, Bulletin 236 1991 p 581-589 Sponsored in part by ARC and QUT (For primary document see N91-27647 19-46)
Avail: Issuing Activity; 15 functional color pages

Synthesis of available data on hydrogeological setting and physico-chemical features of a playa chain in the Karinga Creek palaeo-drainage system of the Amadeus Basin has allowed identification of two broad drainage domains. These domains can be differentiated on the basis of their regional physiographic setting, hydrologic gradients, and mineral assemblages. Field observations, together with dating of ground water deposits in and around the playas, suggest a relatively long period of Quaternary aridity and a generally low velocity regional ground water regime, similar to that of present day. Chemical deposition of carbonate, evaporite, and silica/silicate minerals has been continuous in the ground water and overlying hydrologic zones, with the type and extent of mineralization controlled largely by evaporative concentration of pore solutions, salt recycling, and sediment water interactions. The correlation of field and lab data from playas of the Karinga Creek palaeo-drainage indicate that the cation segregation due to precipitation of authigenic minerals commonly results in large elemental complexity down drainage in the playa brines. Variation in the nature and rate of sediment water interactions appear to locally highly important. Author

N91-27683# Bureau of Mineral Resources, Geology and Geophysics, Canberra (Australia).
THE STRESS REGIME IN THE AMADEUS BASIN REGION
D. Denham and L. Alexander *In its* Geological and Geophysical Studies in the Amadeus Basin, Central Australia, Bulletin 236 1991 p 591-594 (For primary document see N91-27647 19-46)
Avail: Issuing Activity; 15 functional color pages

Evidence from in-situ stress measurements, earthquake focal mechanisms, and borehole deformations indicates that the crust in the Amadeus Basin region, like that in most of Australia, is experiencing compressive stress. The data are not sufficient to determine the stress regime throughout the basin, but results obtained to date indicate that on average the azimuth of the maximum principal stress is probably on the northeastern quadrant. Author

N91-27684# Photometrics, Inc., Woburn, MA.
PROGRAM TO PERFORM RESEARCH ON THE DENSITY OF THE UPPER ATMOSPHERE USING LIDAR TECHNIQUES Final Report, 16 Sep. 1987 - 16 Sep. 1990
Warren P. Moskowitz and Gilbert Davidson 6 Dec. 1990 19 p
(Contract F19628-87-C-0252)
(AD-A235549; PHM-TR-91-04; GL-TR-90-0343) Avail: NTIS HC/MF A03 CSCL 17/5

This report covers a three year program to perform research on atmospheric density and related atmospheric parameters over the altitude region from a few km to approximately 100 km. The Geophysics Laboratory/LIS mobile and fixed lidar systems were used in this research. Field campaigns to WPAFB, Ohio, and Greenland were included in this effort. Useful data on density and temperature were obtained to altitudes above 90 km during the WPAFB campaign, with characteristic time varying density variations observed. Various modifications and upgrades to systems capabilities were made. Density profiles were obtained under both night and day conditions using the mobile lidar. Extensive measurements of nighttime density/temperature profiles were made using the fixed lidar system at GL. GRA

N91-27685# Lowell Univ., MA. Center for Atmospheric Research.
A COMPARISON OF MANUAL SCALED AND PREDICTED foE AND foF1 CRITICAL FREQUENCIES
Robert R. Gamache and William T. Kersey Jul. 1990 55 p
(Contract F19628-90-K-0029)
(AD-A235551; ULRF-459/CAR; GL-TR-90-0214) Avail: NTIS HC/MF A04 CSCL 04/1

The Consultative Committee for International Radio (CCIR) and Titheridge foE critical frequency prediction routines were tested by comparison with 1875 manually scaled values. The foF1 critical frequency prediction routine of Millman et al was tested by comparison with 1005 manually scaled values. Plots and statistics of the comparisons are presented and discussed. From the results, recommendations are made to help improve autoscaling. GRA

N91-27686# State Univ. of New York, Albany. Research Foundation.
SEISMIC EVENT LOCATION IN REGIONAL DISTANCES
C. Thurber 22 Mar. 1991 39 p
(Contract F19628-88-K-0037)
(AD-A235577; Rept-431-6722A-2; PL-TR-91-2028) Avail: NTIS HC/MF A03 CSCL 17/10

Three-component data from regional seismic events recorded by the former NRDC-Soviet Academy of Sciences regional seismic network in Kazakhstan, USSR, have been analyzed with the primary

goal of improving regional seismic event location capability. Data from these events were used in the investigation of the following problems related to regional event location: (1) determination of wave arrival azimuth; (2) observability and value of secondary phase arrivals; (3) evaluation and improvement of regional event location algorithms; (4) independent determination of master event locations. Starting with very little prior information, we have demonstrated the potential for a sparse seismic network of three 3-component stations to locate events over a wide region with reasonable accuracy and precision, both for epicenter and depth. Our basic findings are: that arrival azimuth can be determined with reasonable precision, but the data provide little in the way of location constraint in most cases; secondary phase arrivals are routinely observable over a wide distance range, and they provide important location constraints; existing location algorithms perform well and provide appropriate estimates of location uncertainty, but must be modified for far-regional applications. Numerous master events have been identified and used to improve our location capability. GRA

N91-27687# Science Applications International Corp., Arlington, VA. Center for Seismic Studies.
ANALYSIS OF HIGH FREQUENCY SEISMIC DATA Scientific Report No. 2, 1 Oct. 1989 - 1 Oct. 1990
Hans Israelsson and Jerry Carter 31 Jan. 1991 94 p
(Contract F19628-88-C-0159)
(AD-A235579; SAIC-CSS-TR-90-03; PL-TR-91-2032) Avail: NTIS HC/MF A05 CSCL 08/11

The aim of this research was to characterize the high frequency content of noise and signals, and to develop methods of discriminating between mine blasts and other sources using high frequency seismic data. Data for these studies came from the NORESS small aperture array in Norway and its high frequency (up to 125 Hz) central element. Major research results include: (1) Upper frequency limits of teleseismic P-wave spectra for events recorded at the NORESS high frequency element were between 5 and 20 Hz; (2) Path spectra for explosions from Balapan follow the attenuation models proposed by other authors (apparent t' = 0.14) up to 15 Hz, but from 15 to 20 Hz, the attenuation of the Balapan-NORESS path spectra is greater than that extrapolated from previous models; (3) Scatter in delay times between successive blasts of a ripple-fired explosion have a deteriorating effect on spectral modulation; (4) For the few blasts that are ideal, i.e., have no or negligible errors in time delays, the delay time between shots as well as the number of shots in the explosion can be estimated; (5) The shape of wavefronts from Balapan explosions as recorded at NORESS were nearly identical for 33 events studied; and (6) Wavefronts from events in the N.E. section of the Balapan test site were characterized by a consistent tilt with respect to the wavefronts measured from events in the S.W. section of the test site. GRA

N91-27688# Air Force Geophysics Lab., Hanscom AFB, MA.
DATA REPORT FOR THE 1988 ONTARIO-NEW YORK-NEW ENGLAND SEISMIC REFRACTION EXPERIMENT: SMALL-APERTURE ARRAY Final Report, 1 Oct. 1988 - 30 Sep. 1989
James C. Battis 6 Jul. 1990 57 p
(AF Proj. 7600)
(AD-A235845; GL-TR-90-0178; GL-ERP-1065) Avail: NTIS HC/MF A04 CSCL 08/7

During September 1988, a major crustal refraction and wide-angle reflection survey transecting New England, New York and continuing into Ontario, Canada was conducted. This experiment, the Ontario-New York-New England Seismic Refraction Experiment, was conducted jointly between the Geophysics Laboratory (GL), the U.S. Geologic Survey (USGS), and the Geological Survey of Canada (GSC). The purpose of this program was to better understand the geologic structure and wave propagation characteristics across the northern Appalachians of New England and into the Grenville province to the west. Data collection along the main transect was largely carried out by field teams from the USGS and the GSC. In addition, GL conducted two field programs during the experiment. The main effort was the operation of a series of three-component seismic refraction lines across upstate New York and Vermont. A small-aperture array near North Haverhill, New Hampshire was also operated. This report provides technical background on the data collected by that array. GRA

N91-27689# Spectral Sciences, Inc., Burlington, MA.
LIMB RETRIEVAL CAPABILITY OF THE SPIRIT 3 RADIOMETER
A. S. Zachor 17 Aug. 1990 72 p Prepared in cooperation with Atmospheric Radiation Consultants, Inc., Acton, MA
(Contract F19628-87-C-0130)
(AD-A236351; ARC-TR-90-010; GL-TR-90-0286; SR-5) Avail: NTIS HC/MF A04 CSCL 17/5

Noise levels were predicted as a function of tangent height for limb radiance profiles that will be measured by the SPIRIT 3 radiometer. Synthetic data was inverted to quantify the corresponding uncertainties in retrieved volume emission rates, and to quantify expected errors due to horizontal variations in atmospheric density. A new computer routine for derivative-free Abel inversion is described. GRA

N91-27690# Lowell Univ., MA. Center for Atmospheric Research.
IONOSPHERIC CHARACTERISTICS FOR ARCHIVING AT THE WORLD DATA CENTERS
Robert R. Gamache and Bodo W. Reinisch Dec. 1990 52 p
(Contract F19628-90-K-0029)
(AD-A236645; ULRF-460/CAR; GL-TR-90-0215; SR-3) Avail: NTIS HC/MF A04 CSCL 04/1

A database structure for archiving ionospheric characteristics at uneven data rates was developed at the July 1989 Ionospheric Informatics Working Group (IIWG) Lowell Workshop in Digital Ionogram Data Formats for World Data Center Archiving. This structure is proposed as a new URSI standard and is being employed by the World Data Center A for solar terrestrial physics for archiving characteristics. Here the database has been slightly refined for the application and programs written to generate these database files using as input Digisonde 256 ARTIST data, post processed by the ULCAR ADEP (ARTIST Data Editing Program) system. The characteristics program as well as supplemental programs developed for this task are described here. The new software will make it possible to archive the ionospheric characteristics from the Geophysics Laboratory high latitude Digisonde network, the AWS DISS and the international Digisonde networks, and other ionospheric sounding networks. GRA

N91-27691# Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Engineering Science and Mechanics.
ATMOSPHERIC SURFACE LAYER AND ITS SIMULATION FOR WIND-LOAD STUDIES ON LOW-RISE STRUCTURES
H. W. Tieleman Mar. 1991 95 p
(PB91-174045; VPI-E-91-04) Avail: NTIS HC/MF A05 CSCL 04A

The flow of the atmospheric surface layer is analyzed and summarized with emphasis on those properties which are thought to be of primary importance for the successful prediction of wind pressures on low-rise structures from wind tunnel simulation experiments. Absolute simulation of the flow near the surface can only be achieved if besides geometric and kinematic similarity the Reynolds number of both the mean flow and turbulence can be duplicated. even for flat, smooth and uniform (FSU) upwind terrain, the simulation generally suffers from inequality of the turbulence Reynolds number, which may lead to a deficit of the small-scale spectral densities at wave numbers corresponding to approximately 1/10 the characteristic model dimension. A general spectral model is presented to cover all four terrain categories. However for complex upwind terrain with major topographic features, the behavior of the horizontal velocity spectra are difficult to predict for reduced frequencies of 0.5 and lower. Author

N91-27692# Bureau of Reclamation, Denver, CO. Water Augmentation Group.
DESIGN OF PHYSICAL CLOUD SEEDING EXPERIMENTS FOR THE ARIZONA ATMOSPHERIC MODIFICATION RESEARCH PROGRAM Final Report
A. B. Super, J. G. Medina, and J. T. McPartland Feb. 1991 102 p Sponsored by Arizona Dept. of Water Resources, Phoenix
(PB91-174136; R-91-02) Avail: NTIS HC/MF A06 CSCL 04A

Cloud seeding experiments were designed by the Bureau of Reclamation for winter orographic cloud systems over the Mogollon Rim of Arizona. The experiments are intended to test whether key physical processes proceed as hypothesized during both ground based and aircraft seeding with silver iodide. The experiments are also intended to document each significant link in the chain of physical events following release of seeding material up to, and including, snowfall at the ground at a small research area about 60 km south-southeast of Flagstaff. The physical experimentation should lead to a substantially improved understanding of winter seeding potential in clouds over Arizonia's higher terrain. Such understanding and documentation are a logical prelude to any future experimentation intended to determine seeding impacts over a large area during several winters. Several analysis approaches are suggested to evaluate the physical experiments which range from detailed case study examination to exploratory statistical analysis of experiments pooled into similar classes. Experimental coordination and organization are addressed, and budgets are presented for a five year program. GRA

N91-27693# National Center for Atmospheric Research, Boulder, CO. Atmospheric Chemistry Div.
TEMPERATURE DEPENDENT INFRARED CROSS SECTIONS FOR CFC-11, CFC-12, CFC-13, CFC-14, CFC-22, CFC-113, CFC-114 AND CFC-115
S. T. Massie, A. Goldman, A. H. McDaniel, C. A. Cantrell, and J. A. Davidson Feb. 1991 75 p Sponsored by NSF
(PB91-164780; NCAR/TN-358+STR) Avail: NTIS HC/MF A04 CSCL 04A

Presented here are absorption cross sections at temperatures of 293, 273, 253, 233, 213, and 203K for the chlorofluorocarbon species CFC-11 (CCl3F), CFC-12 (CCl2F2), CFC-13 (CClF3), CFC-14 (CF4), CFC-22 (CHClF2), CFC-113 (C2Cl3Fl3), CFC-114 (C2Cl2F4), and CFC-115 (C2ClF5). The infrared cross sections are those reported by McDaniel et al. (1990), and are displayed in graphical form to facilitate quick identification and quantification of CFC gases in high and medium resolution remote sensing studies. Author

N91-27598*# Pennsylvania State Univ., University Park.
ICE-ATMOSPHERE INTERACTIONS IN THE POLAR OCEANS
Robert Crane *In its* An Assessment of NASA Master Directory/Catalog Interoperability for Interdisciplinary Study of the Global Water Cycle 1 May 1991 p 5-9 (For primary document see N91-27597 19-42)
Avail: NTIS HC/MF A03 CSCL 04A

N91-27599*# Pennsylvania State Univ., University Park.
DETERMINATION AND IMPACT OF SURFACE RADIATIVE PROCESSES FOR TOGA COARE
Judith A. Curry, Thomas Ackerman, William B. Rossow, and Peter J. Webster *In its* An Assessment of NASA Master Directory/Catalog Interoperability for Interdisciplinary Study of the Global Water Cycle 1 May 1991 p 10-21 (For primary document see N91-27597 19-42)
Avail: NTIS HC/MF A03 CSCL 04A

47 METEOROLOGY AND CLIMATOLOGY

Includes weather forecasting and modification.

N91-27694*# Wisconsin Univ., Madison. Space Science and Engineering Center.
ATLAS OF THE GLOBAL DISTRIBUTION OF ATMOSPHERIC HEATING DURING THE GLOBAL WEATHER EXPERIMENT Report, Dec. 1978 - Nov. 1979
Todd K. Schaack and Donald R. Johnson Washington May 1991 151 p
(Grant NAG5-81)
(NASA-CR-4370; Rept-91A01339; NAS 1.26:4370) Avail: NTIS HC/MF A08 CSCL 04B

Global distributions of atmospheric heating for the annual cycle of the Global Weather Experiment are estimated from the European Centre for Medium-Range Weather Forecasts (ECMWF) Level 3b data set. Distributions of monthly, seasonally, and annually averaged heating are presented for isentropic and isobaric layers within the troposphere and for the troposphere as a whole. The distributions depict a large-scale structure of atmospheric heating that appears spatially and temporally consistent with known features of the global circulation and the seasonal evolution. Author

N91-27695*# Massachusetts Inst. of Tech., Cambridge. Dept. of Civil Engineering.
ATMOSPHERIC WATER VAPOR TRANSPORT: ESTIMATION OF CONTINENTAL PRECIPITATION RECYCLING AND PARAMETERIZATION OF A SIMPLE CLIMATE MODEL M.S. Thesis
Kaye L. Brubaker, Dara Entekhabi, and Peter S. Eagleson Jul. 1991 167 p
(Grant NAG5-743)
(NASA-CR-188647; NAS 1.26:188647; R91-18; MIT-TR-333)
Avail: NTIS HC/MF A08 CSCL 04B

The advective transport of atmospheric water vapor and its role in global hydrology and the water balance of continental regions are discussed and explored. The data set consists of ten years of global wind and humidity observations interpolated onto a regular grid by objective analysis. Atmospheric water vapor fluxes across the boundaries of selected continental regions are displayed graphically. The water vapor flux data are used to investigate the sources of continental precipitation. The total amount of water that precipitates on large continental regions is supplied by two mechanisms: (1) advection from surrounding areas external to the region; and (2) evaporation and transpiration from the land surface recycling of precipitation over the continental area. The degree to which regional precipitation is supplied by recycled moisture is a potentially significant climate feedback mechanism and land surface-atmosphere interaction, which may contribute to the persistence and intensification of droughts. A simplified model of the atmospheric moisture over continents and simultaneous estimates of regional precipitation are employed to estimate, for several large continental regions, the fraction of precipitation that is locally derived. In a separate, but related, study estimates of ocean to land water vapor transport are used to parameterize an existing simple climate model, containing both land and ocean surfaces, that is intended to mimic the dynamics of continental climates. Author

N91-27696*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, MD.
A CASE STUDY DEMONSTRATION OF THE SOIL TEMPERATURE EXTREMA RECOVERY RATES AFTER PRECIPITATION COOLING AT 10-cm SOIL DEPTH
Jean Edward Welker Washington Jun. 1991 31 p
(NASA-TM-100731; Rept-89B00116; NAS 1.15:100731) Avail: NTIS HC/MF A03 CSCL 04B

Since the invention of maximum and minimum thermometers in the 18th century, diurnal temperature extrema have been taken for air worldwide. At some stations, these extrema temperatures were collected at various soil depths also, and the behavior of these temperatures at a 10-cm depth at the Tifton Experimental

Station in Georgia is presented. After a precipitation cooling event, the diurnal temperature maxima drop to a minimum value and then start a recovery to higher values (similar to thermal inertia). This recovery represents a measure of response to heating as a function of soil moisture and soil property. Eight different curves were fitted to a wide variety of data sets for different stations and years, and both power and exponential curves were fitted to a wide variety of data sets for different stations and years. Both power and exponential curve fits were consistently found to be statistically accurate least-square fit representations of the raw data recovery values. The predictive procedures used here were multivariate regression analyses, which are applicable to soils at a variety of depths besides the 10-cm depth presented. Author

N91-27697*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, AL.
THE NASA/MSFC GLOBAL REFERENCE ATMOSPHERIC MODEL: 1990 VERSION (GRAM-90). PART 2: PROGRAM/DATA LISTINGS
C. G. Justus, F. N. Alyea, D. M. Cunnold, W. R. Jeffries, III (New Technology, Inc., Huntsville, AL.), and D. L. Johnson Washington Jun. 1991 816 p
(Grant NAG8-078)
(NASA-TM-4268-Pt-2; M-657; NAS 1.15:4268-Pt-2) Avail: NTIS HC/MF A99 CSCL 04B

A new (1990) version of the NASA/MSFC Global Reference Atmospheric Model (GRAM-90) was completed and the program and key data base listing are presented. GRAM-90 incorporate extensive new data, mostly collected under the Middle Atmosphere Program, to produce a completely revised middle atmosphere model (20 to 120 km). At altitudes greater than 120 km, GRAM-90 uses the NASA Marshall Engineering Thermosphere model. Complete listings of all program and major data bases are presented. Also, a test case is included. Author

N91-27698# Woods Hole Oceanographic Inst., MA.
OCEAN RESPONSE TO A HURRICANE. PART 2: DATA TABULATIONS AND NUMERICAL MODELING
James F. Price, Thomas B. Sanford, and George Z. Forristall Jan. 1991 71 p
(Contract N00014-89-J-1053)
(AD-A236059; WHOI-91-06-Pt-2) Avail: NTIS HC/MF A04 CSCL 04/2

Field observations of the ocean's forced stage response to hurricanes Norbert (1984), Josephine (1984), and Gloria (1985) are analyzed and presented in a storm centered coordinate system. Data are simulated with two different numerical ocean models. All three hurricanes had a non-dimensional speed of O(1) and produced a strongly rightward biased response of the ocean surface mixed layer (SML) transport and current. This asymmetry arises because the wind stress vector rotates clockwise on the right side of the track and remains nearly parallel with the inertially rotating SML current during most of the hurricane passage. The maximum layer-averaged SML currents varied from 0.8 m/s in response to Josephine, a fairly weak hurricane, to 1.7 m/s in response to Gloria which was much stronger. In these cases, the current amplitude is set primarily by the strength of the wind stress, its efficiency of coupling with the SML current, and the depth of vertical mixing of the SML (all of which are local phenomena that can be accounted for in a one-dimensional model). However, in the Norbert case where the SML Burger number was appreciable, the SML current was also affected by significant pressure, coupling with the thermocline, (an inherently non-local phenomenon). Observations and results from a three dimensional simulation model show appreciable upwelling by inertial pumping and strong thermocline depth currents, up to 0.3 m/s, under the trailing edge of Norbert. The observed SML current has a vertical shear in the direction of the local wind of about 0.01 m/s, and has been simulated with some success by a one dimensional turbulence closure model. GRA

N91-27699# Naval Postgraduate School, Monterey, CA.
CEAREX/HAAKON MOSBY METEOROLOGY ATLAS Final Report
P. A. Frederickson, P. S. Guest, and K. L. Davidson Aug. 1990 62 p
(AD-A236752; AD-E040025; NOARL-TN-82) Avail: NTIS HC/MF A04 CSCL 04/2

The Coordinated Eastern Arctic Experiment (CEAREX) was conducted in the vicinity of the Svalbard Island group from September 1988 to May 1989. Personnel aboard the R/V Haakon Mosby participated in the Seasonal Ice Zone Experiment (SIZEX) phase of the project, taking continuous surface and upper air measurements during the period 25 Feb. to 23 Mar. 89. This report describes equipment and methods used in data acquisition and analysis, and summarizes observations by presenting data in three forms: (1) Time series plots of surface pressure, wind speed and direction, air temperature, dew point temperature, and relative humidity; (2) Vertical soundings of potential temperature, potential dew point temperature, specific humidity, and wind speed and direction; and (3) Daily sea level pressure analyses. GRA

N91-27700# KTAADN, Inc., Newton, MA.
IMPROVED ANS LIGHTNING PREDICTORS USING ADDITIONAL SURFACE WIND AND ELECTRIC FIELD DATA Final Report, 4 May - 31 Dec. 1990
Donald S. Frankel 31 Dec. 1990 42 p
(Contract F19628-89-C-0012)
(AD-A236771; GL-TR-90-0361) Avail: NTIS HC/MF A03 CSCL 04/2

Because of the destruction by lightning of the Atlas-Centaur 67 and its communication satellite payload on 27 March 1987, new launch commit criteria with respect to lightning were imposed by NASA and the Air Force for missile launches from the national ranges. These criteria are very conservative and restrict the available launch windows, especially during summer months at Kennedy Space Center (KSC) and Cape Canaveral Air Force Station (CCAFS) in Florida. In an effort to expand the launch windows while maintaining safety, it is shown that neural networks can be trained to generate spatio-temporal maps of predicted probabilities of lightning over the CCAFS/KSC complex. Input data used for training and testing the neural networks include the five minute averages from all 53 wind sensors, the Total Area Divergence product calculated by Watson, the occurrence of lightning strikes as recorded by magnetic direction finders, and most recently, the electric field mill data. Training the neural network lightning predictor with wind data spanning two days of data and the divergence product increased the PoD to 0.65. The predictor's best performance is at 30 to 60 minutes in the future. The electric field data is expected to affect near term prediction more than later times. GRA

N91-27701*# Illinois State Water Survey, Champaign.
A VARIATIONAL ASSIMILATION METHOD FOR SATELLITE AND CONVENTIONAL DATA: DEVELOPMENT OF BASIC MODEL FOR DIAGNOSIS OF CYCLONE SYSTEMS Final Report
G. L. Achtemeier, R. W. Scott, and J. Chen Jun. 1991 163 p
(Grant NAG8-059)
(NASA-CR-188667; NAS 1.26:188667) Avail: NTIS HC/MF A08 CSCL 04B

The following subject areas are covered: (1) A variational assimilation method for satellite and conventional data: MODEL II (Version 1) and a revised basic MODEL IIB; (2) A variational formalism for the radiative transfer equation and a geostrophic, hydrostatic atmosphere: prelude to MODEL III; (3) The concept of varying influence radii for a successive corrections objective analysis; and (4) Modification of a successive corrections objective analysis for improved derivative calculations. Author

N91-27702*# ST Systems Corp., Hampton, VA.
RADIOMETER OFFSETS AND COUNT CONVERSION COEFFICIENTS FOR THE EARTH RADIATION BUDGET EXPERIMENT (ERBE) SPACECRAFT FOR THE YEARS 1984, 1985, AND 1986 Final Report
Jack Paden, Dhirendra K. Pandey, Netra D. Shivakumar, Joseph C. Stassi, Robert Wilson, William Bolden, Susan Thomas, and M. Alan Gibson May 1991 388 p
(Contract NAS1-18460)
(NASA-CR-187589; NAS 1.26:187589; STX(H)-91/01) Avail: NTIS HC/MF A17 CSCL 04B

A compendium is presented of the ground and inflight scanner and nonscanner offsets and count conversion (gain) coefficients used for the Earth Radiation Budget Experiment (ERBE) production processing of data from the ERBS, NOAA-9, and NOAA-10 satellites for the 1 Nov. 1984 to 31 Dec. 1986. Author

N91-27703# National Oceanic and Atmospheric Administration, Rockville, MD. Federal Coordinator for Meteorological Services and Supporting Research.
DOPPLER RADAR METEOROLOGICAL OBSERVATIONS. PART B: DOPPLER RADAR THEORY AND METEOROLOGY (INTERIM VERSION ONE)
Jun. 1990 227 p Original contains color illustrations
(PB91-176701; FCM-H11B-1990) Avail: NTIS HC/MF A11 CSCL 04B

Federal Meteorological Handbook Number 11 (FMH 11), 'Doppler Radar Meteorological Observations', was prepared and published. The purpose of FMG 11 is to standardize, insofar as practical, the operation of the weather surveillance radar - 1988, Doppler (WSR-88D) units and the procedures used by personnel of the Departments of Commerce, Defense, and Transportation. In all, FMH 11 has four parts: Part A - System Concepts, Responsibilites, and Procedures; Part B - Doppler Radar Theory and Meteorology; Part C - WSR-88D Products and Algorithms; Part D - WSR-88D Unit Description and Operational Applications. Part B brings together into one document most of the theory required to understand how the WSR-88D acquires and processes the Doppler radar signal. It presents mathematical formulations of the physical processes and laws, explains how the Doppler technology sees various meteorological and hydrological events, and explores the strengths and problems in data acquisition with a Doppler radar. It then addresses aspects of radar meteorology regarding recognition of velocity patterns and applications of Doppler radar to storm events, including hurricanes. Part B should be required reading to establish a foundation for users of the WSR-88D. For those desiring a deeper technical understanding, Part B provides a bibliography of the relevant scientific literature. GRA

N91-27704# Environmental Protection Agency, Cincinnati, OH. Risk Reduction Engineering Lab.
RAINFALL DATA ANALYSIS USING THE GAMMA DISTRIBUTION FUNCTION
R. G. Eilers Mar. 1991 28 p Presented at the 7th Annual EPA Conference on Statistics, Richmond, VA, Mar. 1991
(PB91-176834; EPA/600/D-91/030) Avail: NTIS HC/MF A03 CSCL 04B

The Gamma distribution function can be useful for fitting rainfall data. An integral part of the assessment of storm loads on water quality is the statistical evaluation of rainfall records. Hourly rainfall records of many years duration are cumbersome and difficult to analyze. The Gamma distribution can be a tool to examine variables of interest (volume, duration, intensity, and time between storms) which are of importance in determining seasonal trends and selecting control alternatives for storm related runoff. GRA

N91-27705# National Hurricane Center, Coral Gables, FL.
DIAGNOSTIC REPORT OF THE NATIONAL HURRICANE CENTER, JUNE AND JULY 1990, VOLUME 3, NUMBER 1
C. J. McAdie and E. N. Rappaport 1990 67 p
(PB91-173161) Avail: NTIS HC/MF A04 CSCL 04B

The following subject areas are covered: (1) Overview of tropical activity for June and July 1990 (mean flow patterns for the Atlantic and Eastern Pacific Basins and tropical wave and tropical cyclone summary); (2) Tropical cyclone activity in the Atlantic Basin (overview, preliminary report, and official forecast performance); and (3) Tropical cyclone activity in the Eastern Pacific Basin (overview, preliminary reports, and official forecast performance). Author

N91-27706# National Oceanic and Atmospheric Administration, Boulder, CO. Climate Monitoring and Diagnostics Lab.
ECC OZONESONDE OBSERVATIONS AT POINT BARROW, ALASKA DURING JANUARY 16 - APRIL 19, 1989
W. D. Komhyr, J. Wendell, and J. A. Lathrop Mar. 1991 162 p
(PB91-176438; NOAA-DR-ERL-CMDL-7) Avail: NTIS HC/MF A08 CSCL 04B

Measurements of the vertical distribution of ozone and air temperature were made with ECC ozonesondes January 16 - April 19, 1989, at Point Barrow, Alaska, in an attempt to detect whether the stratospheric ozone depletion that occurs during the austral winter and spring in Antarctica also occurs during the winter and spring in the Arctic. Of 33 soundings made, 17 measured total ozone amounts of 400-531 Dobson units (DU), 13 measured 350-399 DU total ozone, and 1 measured 304 DU total ozone. Two soundings did not attain high enough altitudes for estimates of total ozone to be made. In contrast, total ozone amounts in winter and spring in Antarctica in recent years have ranged from about 125 to 275 DU. Stratospheric air temperatures over Point Barrow were never colder than -70 C and were often as warm as -50 C. No unequivocal evidence of photochemical ozone destruction such as that which occurs in Antarctica in the presence of polar stratospheric clouds appears on the ozone profiles presented here. Neither is there any evidence in the profiles of stratospheric transport to Point Barrow of partially depleted ozone from the eastern Arctic. Author

N91-27707# National Oceanic and Atmospheric Administration, Miami, FL. Atlantic Oceanographic and Meteorological Labs.
SHIPBOARD ACOUSTIC DOPPLER CURRENT PROFILER DATA COLLECTED DURING THE SUBTROPICAL ATLANTIC CLIMATE STUDIES (STACS) PROJECT Data Report, 1983-1986
A. M. Wilburn Mar. 1991 177 p
(PB91-178400; NOAA-DR-ERL-AOML-20) Avail: NTIS HC/MF A09 CSCL 04B

Ocean current profiles measured during the Subtropical Atlantic Climate Studies (STACS) project of NOAA between December 1983 and September 1987 are described. The STACS project is directed at determining the role of ocean circulation in global atmosphere climate, obtaining data for numerical model verification, and establishing monitoring strategies for climatically important circulation features. The data were collected aboard NOAA research ships in the Florida Current, Caribbean Sea, the Antillean Archipelago, and down to 4 degrees north latitude using the acoustic Doppler current profiler. Author

N91-27708# National Environmental Satellite Service, Washington, DC. Climate Analysis Center.
PROCEEDINGS OF THE 15TH ANNUAL CLIMATE DIAGNOSTICS WORKSHOP
Mar. 1991 556 p Workshop held in Asheville, NC, 29 Oct. - 2 Nov. 11990
(PB91-171082) Avail: NTIS HC/MF A24 CSCL 04B

The Fifteenth Annual Climate Diagnostics Workshop was hosted by the National Climatic Data Center/ National Environment Satellite, Data, and Information Service (NESDIS) in Asheville, NC. The proceedings provide a published record of the presentations made at the workshop. The workshop had sessions on the following topics: recent climate anomalies; El Nino/Southern Oscillation (ENSO); interannual variability; intraseasonal variability; low-frequency variability and blocking; climate data sets; ocean-atmosphere interaction observation and models; climate impacts; regional climate studies; and climate prediction. In addition,

there were special sessions on the Automated Surface Observation System (ASOS) and Regional Climate Centers (RCC) Program.
GRA

N91-27709# Nevada Univ., Reno. Desert Research Inst.
SNOW/RAIN COLLECTOR SAMPLER
R. G. Purcell and R. B. Brown Mar. 1991 49 p Sponsored by EPA, Research Triangle Park, NC
(Contract EPA-68-D-80095)
(PB91-167601; EPA/600/3-91/005) Avail: NTIS HC/MF A03 CSCL 04B

A new snow/rain collector was designed, built, and field tested. The instrument was designed to be able to operate in all weather conditions at remote and unattended sites for up to seven days. The design criteria also included stipulations that the instrument be easily operated by non-technical personnel, be convenient for transfer of collected precipitation samples, and have provisions for excluding dry deposition. The instrument was field tested and test results are included. Author

N91-27710# National Environmental Satellite Service, Washington, DC. Satellite Applications Lab.
A WATER VAPOR IMAGE FEATURE RELATED TO SEVERE THUNDERSTORMS
Gary P. Ellrod Nov. 1990 9 p Repr. from National Weather Digest, v. 15, no. 4 p 21-29
Avail: NTIS HC/MF A02

A persistent V or C-shaped dark band sometimes observed in Geostationary Operational Environment Satellite water vapor imagery near the upstream edges of a thunderstorm's cirrus anvil may indicate the likelihood of severe weather. The subtle feature can also be oval or circular in appearance. One hundred and forty-seven convective storms were observed to have this feature during the spring and early summer of 1989. Eighty-two percent of the storms were severe. The predominant type of severe weather observed was large hail. Author

N91-27711*# South Dakota School of Mines and Technology, Rapid City. Inst. of Atmospheric Sciences.
A CLOUD, PRECIPITATION AND ELECTRIFICATION MODELING EFFORT FOR COHMEX Final Technical Report, 20 May 1987 - 19 May 1991
Harold D. Orville, John H. Helsdon, and Richard D. Farley Aug. 1991 20 p
(Grant NAG8-632)
(NASA-CR-188679; NAS 1.26:188679; SDSMT/IAS/R-91/04)
Avail: NTIS HC/MF A03 CSCL 04B

In mid-1987, the Modeling Group of the Institute of Atmospheric Sciences (IAS) began to simulate and analyze cloud runs that were made during the Cooperative Huntsville Meteorological Experiment (COHMEX) Project and later. The cloud model was run nearly every day during the summer 1986 COHMEX Project. The Modeling Group was then funded to analyze the results, make further modeling tests, and help explain the precipitation processes in the Southeastern United States. The main science objectives of COHMEX were: (1) to observe the prestorm environment and understand the physical mechanisms leading to the formation of small convective systems and processes controlling the production of precipitation; (2) to describe the structure of small convective systems producing precipitation including the large and small scale events in the environment surrounding the developing and mature convective system; (3) to understand the interrelationships between electrical activity within the convective system and the process of precipitation; and (4) to develop and test numerical models describing the boundary layer, tropospheric, and cloud scale thermodynamics and dynamics associated with small convective systems. The latter three of these objectives were addressed by the modeling activities of the IAS. A series of cloud modes were used to simulate the clouds that formed during the operational project. The primary models used to date on the project were a two dimensional bulk water model, a two dimensional electrical model, and to a lesser extent, a two dimensional detailed microphysical cloud model. All of the models are based on fully interacting microphysics, dynamics, thermodynamics, and electrical equations. Only the 20 July 1986 case was analyzed in detail, although all of the cases run during the summer were analyzed as to how well they did in predicting the characteristics of the convection for that day. Author

N91-27600*# Pennsylvania State Univ., University Park.
CLIMATE AND SOCIETY IN 20TH CENTURY MEXICO
Diana M. Liverman *In its* An Assessment of NASA Master Directory/Catalog Interoperability for Interdisciplinary Study of the Global Water Cycle 1 May 1991 p 22-31 (For primary document see N91-27597 19-42)
Avail: NTIS HC/MF A03 CSCL 04B

N91-28071*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, CA.
SEASONAL NITROUS OXIDE FLUX FROM AN INTENSIVELY MANAGED PASTURE IN A HUMID SUBTROPICAL ECOSYSTEM Abstract Only
Eugene A. Brams, W. H. Anthony, G. L. Hutchinson (Agricultural Research Service, Fort Collins, CO.), and G. P. Livingston *In* Alabama A & M Univ., NASA-HBCU Space Science and Engineering Research Forum Proceedings 1989 p 45 (For primary document see N91-28063 19-99)
Avail: NTIS HC/MF A23 CSCL 04B

48 OCEANOGRAPHY

Includes biological, dynamic, and physical oceanography; and marine resources.

For related information see also *43 Earth Resources and Remote Sensing.*

N91-27712# Stanford Univ., CA. Center for Large Scale Scientific Computation.
AN ACCURATE HYPERBOLIC SYSTEM FOR OCEANOGRAPHIC FLOWS Interim Report, Jan. 1988 - Jun. 1990
Amala Krishna, Joseph Oliger, and Robert L. Street Jun. 1990 20 p
(AD-A234072; CLASSIC-MS-90-24) Avail: NTIS HC/MF A03 CSCL 08/3

The basic equations for a compressible, non-hydrostatic flow is scaled based on oceanographic data to obtain a set of hyperbolic equations that is well-posed for the initial boundary value problem. An advantage is found in using salinity and potential temperature as primitive variables instead of density, since the equations used for a compressible flow are then linearly independent. These are scaled in a much simpler manner than has been done by Browning et al. It is also shown that it is essential to include the Coriolis term arising from the component of the earth's angular velocity acting tangential to the earths's surface in order to model the vertical velocity accurately. GRA

N91-27713# Naval Oceanographic and Atmospheric Research Lab., Bay Saint Louis, MS.
ACCURACY OF OCEAN COLOR DATA DERIVED FROM THE COASTAL ZONE COLOR SCANNER (CZCS) Final Report
G. D. Hickman, S. C. Gallegos, and M. J. Duggin Mar. 1991 20 p Prepared in cooperation with State Univ. of New York, Syracuse
(AD-A235719; AD-E040004; NOARL-TN-116) Avail: NTIS HC/MF A03 CSCL 17/5

The U.S. Navy is interested in investigating the use of ocean color data for naval applications, as they apply within the Air Defense Initiative. The major source of available data for assessment is the Coastal Zone Color Scanner (CZCS) data base. These data were collected during 1979 to 1986. Although the CZCS is no longer operational, much information has been published on the analysis of the data. This technical note reviews that literature, which deals primarily with the measured and estimated errors associated with using the CZCS data to derive

either chlorophyll concentrations (C) or the diffuse attenuation coefficient (K) of oceanic waters. The recognized uncertainties in the absolute values of the quantities of C and K must be taken into account when addressing the potential use of CZCS data for certain naval applications. The literature generally agrees that on a global basis, K or C can be determined from CZCS data to only within a factor of 2, as compared with in situ measurements. In addition, the water-leaving radiance for one spectral band can probably be obtained from the CZCS data, but in a more regional or smaller geographical area, after corrections to within +/- 15 percent. This percentage relates to an error approximately +/- 30 percent in K or C, both of which use a ratio of at least two spectral bands. Extreme care must be taken in applying the appropriate corrections on a pixel-to-pixel basis if the error is to be reduced to this value. If the concern is with only spatial trends of water clarity at a particular point in time or with temporal trends at each point in space, the CZCS images can probably be used; however, the conditions under which they apply must be indicated. A preliminary computer simulation that focuses on the impact of some of the data errors is also included. GRA

N91-27714# Naval Research Lab., Washington, DC.
A REVIEW OF EXPERIMENTAL OBSERVATIONS AND REMAINING QUESTIONS CONCERNING FORMATION, PERSISTENCE, AND DISAPPEARANCE OF SEA SLICKS Final Report, 20 Apr. - 30 Sep. 1990
William R. Barger 6 May 1991 50 p
(NR Proj. RR0-1301)
(AD-A235802; NRL-9313) Avail: NTIS HC/MF A03 CSCL 08/3

Over 500 articles related to questions concerned with understanding the forces that act to control the formation, persistance, and disappearance of sea slicks and to determine their properties have been gathered and cross-indexed under a set of key words. A brief review of current thinking about slicks drawing on the database of listed references is presented. Recent results from the literature comparing dynamic and static surface dilational modulus data are summarized. To provide an illustrative example for the general discussion, new data for a single natural film formed on the surface of a seawater sample are presented. The natural sample was characterized by determining its film pressure, modulus, surface potential, and corresponding damping coefficients for 30 Hz capillary waves as a function of the area occupied by the film. These were compared to corresponding data for two pure compounds that form monomolecular films on seawater. Previously unpublished data on the spontaneous spreading rates of 10 pure surface-active compounds were used to determine the relationship between spreading velocity and surface tension gradient. Topics in need of further study where data for natural films are scarce or nonexistent are identified. GRA

N91-27715# Naval Oceanographic and Atmospheric Research Lab., Bay Saint Louis, MS.
PROCEEDINGS OF THE AUTOMATED INTERPRETATION OF OCEANOGRAPHIC SATELLITE IMAGES WORKSHOP Final Report
Matthew Lybanon Feb. 1991 230 p Workshop held at Bay St. Louis, MS, 13-14 Sep. 1990
(AD-A235811; AD-E040006; NOARL-SP-001-321-91) Avail: NTIS HC/MF A11 CSCL 08/3

Work that is potentially of great benefit to the U.S. Navy is described. The provision of automated or semiautomated tools to aid the oceanographic satellite data interpreter has the potential to make a significant contribution to the exploitation of remotely sensed observations to satisfy Navy requirements. The techniques themselves are of considerable scientific interest, since they indicate a high degree of success in dealing with a number of difficult technical problems. The cooperation between Government, academic, and industrial researchers which the papers represent serves as a model for future partnerships. GRA

N91-27716# Miami Univ., Coral Gables, FL.
AN ISOPYCNIC COORDINATE NUMERICAL MODEL OF THE AGULHAS CURRENT WITH COMPARISON TO OBSERVATIONS M.S. Thesis
Kevin A. Maillet Dec. 1990 84 p
(AD-A236022) Avail: NTIS HC/MF A05 CSCL 08/3

Numerical modeling of the Agulhas Current in a limited domain begun by Boudra and Chassignet (1988) is extended. First, five experiments designed to investigate the effects of increased vertical resolution and isopycnal coordinate interface outcropping on the model retroflection and rings are described. Next, two experiments carried out in a more realistically sized basin with more realistic coastal geometry are compared with observations recently collected in the Agulhas region. Five experiments are described to investigate increased vertical resolution and interface outcropping. They proceed from a 3-layer case to a 5-layer case with very thin upper layers. Isopycnal outcropping along the subtropical convergence and around the edge of the Indian Ocean subtropical gyre is a primary feature of three of the new experiments. In addition, some characteristics of ring formation are more realistic than in previously published experiments: e.g., formation is more frequent and is typically west or southwest of the Agulhas Bank as opposed to on the southeast side. The new experiments are generally less energetic. Energy input by the wind is pumped into the lower layers through baroclinic instability and dissipated more efficiently. A three layer experiment and a five layer experiment are run in a larger domain configured on a Mercator projection in order to compare the results to the observations. GRA

N91-27717# Army Cold Regions Research and Engineering Lab., Hanover, NH.
SEA ICE OBSERVATIONS FROM THE WINTER WEDDELL GYRE STUDY, 1989 Special Report
Debra A. Meese, John W. Govoni, Vladimir Churun, Boris Ivanov, and Victor Komarovskiy Feb. 1991 166 p
(AD-A236036; CRREL-SR-91-2) Avail: NTIS HC/MF A08 CSCL 08/12

Data for this report were obtained during the Winter Weddell Gyre Study-1989 from the Soviet icebreaker Akademik Fedorov. This study took place between September and November 1989 in the Weddell Sea, Antarctica. Several times each day throughout the cruise, we took notes on the ice conditions that the ship was passing through at that time. These notes included ice concentration, thickness, ice type, amount of ridging, number of icebergs in the area, and other distinguishing characteristics. Photos of the area are included. During the cruise, a Soviet ice scientist was stationed on the bridge 24 hours a day to compile detailed ice observation maps. These maps contain information for every mile of ice that was passed through during the cruise, including: ice thickness, type, and concentration; iceberg size, number, and type; and the extent and size of leads. Copies of their maps are included. Every 30 to 60 miles during the cruise we would stop for an ice station where ice cores and water measurements were made. At each site, an ice map of the station was compiled, including wind direction and speed, air temperature, ice type, ice thickness, and other characteristics of the area. Copies of these maps are included. Daily satellite photos of the area the ship was traversing are also provided. GRA

N91-27718# Naval Oceanographic and Atmospheric Research Lab., Bay Saint Louis, MS.
THE EFFECTS OF SOUND SPEED ON THE SHAPE OF THE OCEAN IMPULSE RESPONSE
R. L. Field and M. K. Broadhead 1991 14 p Repr. from Ocean Variability and Acoustic Propagation, 1991 p 57-68 Presented at workshop, La Spezia, Italy, 4-8 Jun. 1990
(AD-A236567; AD-E040012; NOARL-PR-90-051-244) Avail: NTIS HC/MF A03 CSCL 20/1

The effects of sound speed on the shape of the ocean impulse response measured within the shadow zone are investigated at a range of 12 km and depths of 489, 677, and 841 m. Measured impulse responses are computed by cross-correlating received

signals at these depths with a source replica of 35 to 55 Hz bandwidth. Time waveform envelopes of the measured responses are compared with envelopes computed by a time-domain parabolic equation model for three sound speed cases. It is found that the envelopes of these responses are predictable enough to remove propagational distortion by deconvolving the data envelope with the model envelope; thus, useful source signal characteristics are extracted. GRA

N91-27719# Naval Oceanographic and Atmospheric Research Lab., Bay Saint Louis, MS.
INVESTIGATION OF BOUNDARY LAYER MODIFICATION DURING GUFMEX
William T. Thompson and Stephen D. Burk May 1991 6 p Repr. 5th Conf. on Meteorology and Oceanography of the Canal Zone, May 1991 p 86-90
(AD-A236744; PR-90-031-442) Avail: NTIS HC/MF A02 CSCL 04/2

Transformation of continental polar air tranversing the Gulf of Mexico has been documented by few authors. Dimego et. al. (1976) provide a climatology of cold frontal incursions into the Gulf and return flow of warm, moist tropical air into midlatitudes. Their results indicate that the maximum mean monthly frequency of frontal systems occurs in February. Molinari (1987) discusses air mass transformation over the loop current in the eastern Gulf. The loop current causes relatively warm water to move northward through the Yucatan Channel into the eastern Gulf. Changes in the position of the loop current contribute to significant variability in surface latent and sensible heat fluxes and, therefore, variability in air mass transformation (AMT). Boundary layer (BL) modification associated with AMT is discussed by Henry and Thompson (1976). Using soundings from a station in southern Mississippi and from one on the Yucatan Peninsula 24 hours later, they estimate the average total surface heat flux during the 24 hours required for air parcels reaching Yucatan. GRA

N91-27720# Nederlands Inst. voor Onderzoek der Zee, Texel.
PALEOCEANOGRAPHY AND GEOCHEMISTRY OF THE ANGOLA BASIN (SOUTH ATLANTIC OCEAN). CRUISE REPORT R. V. TYRO, SEPTEMBER 30 - NOVEMBER 19, 1989
J. H. F. Jansen, G. J. deLange, and A. J. vanBannekom 1990 66 p IN ENGLISH and DUTCH
(PB91-177444; NIOZ-1990-4) Avail: NTIS HC/MF A04 CSCL 08C

The main objective of the expedition is to study the meaning of oceanographic parameters and paleoceanographic signals and their alterations within the sediments before they will be buried for a long time. Special attention will be directed to Al-rich opal and its influence on the silica cycle, and the deep-water circulation of the Angola and Guinee Basins. Diagenetic alterations and fluxes into and out of the sediment will be studied in relation to conversion processes of organic compounds. The final aim is to make the results applicable for paleoceanographic studies, in particular of the history of the deep-ocean waters (AABW), and for paleoclimatic studies. Author

N91-27721# National Oceanic and Atmospheric Administration, Seattle, WA. Pacific Marine Environmental Lab.
STRUCTURE OF THE MARINE BOUNDARY LAYER OVER THE PACIFIC OCEAN DURING THE RITS 88 AND RITS 89 CRUISES
J. E. Johnson and W. Mitchell Feb. 1991 111 p
(PB91-176412; NOAA-DR-ERL-PMEL-27; CONTRIB-1272) Avail: NTIS HC/MF A06 CSCL 08C

During 1988 and 1989, research cruises were conducted onboard the NOAA ships Oceanographer and Discoverer respectively, as part of NOAA's Radiatively Important Trace Species (RITS) Program. The mission of the RITS cruises was to measure the latitudinal distribution of trace species that are climatically important and to determine the role of the ocean in controlling and modifying the cycling of these gases through the atmosphere. To this end, continuous measurements were made of CO2, CO, CH4, and (CH3)2S in the atmosphere (at ship level) and in seawater. Measurements of the atmospheric aerosol concentrations, size distributions, and chemistry also were made. To aid in the interpretation of processes controlling the measured changes in the concentration of these species, measurements were made of the structure of the atmospheric boundary layer using high resolution radiosonded. These radiosondes were launched on balloons and measured dry and wet bulb temperatures as a function of pressure. The radiosonde observation system and the data reduction are described. Also presented are plots of each sounding and latitude-height relative humidity cross sections for each cruise and hourly weather observations collected by ship's personnel. GRA

N91-27722# Minerals Management Service, Herndon, VA. Atlantic OCS Region.
NORTH CAROLINA PHYSICAL OCEANOGRAPHY PANEL REPORT Final Report
J. V. Mullin Apr. 1991 51 p
(PB91-178046; OCS/MMS-91/0011) Avail: NTIS HC/MF A04 CSCL 08C

The report is the result of a panel review consisting of three physical oceanographers chosen by the Secretary of the Interior, the Governor of North Carolina and one chosen jointly by the Secretary and the Governor of North Carolina. The panel evaluated the Mobil report entitled, Characterization of Currents at Manteo Block 467 off Cape Hatteras, North Carolina. In addition, the panel was charged to provide recommendations, on the need for additional physical oceanographic field measurements between the mouth of the Chesapeake Bay and Cape Hatteras, North Carolina. GRA

51 LIFE SCIENCES (GENERAL)

N91-27723# Rensselaer Polytechnic Inst., Troy, NY.
PHYLOGENETIC RELATIONSHIPS AMONG SUBSURFACE MICROORGANISMS
S. A. Nierzwicki-Bauer 1991 10 p
(Contract DE-FG02-90ER-60989)
(DE91-009838; DOE/ER-60989/1) Avail: NTIS HC/MF A02

This report summarizes the progress made from Jun. 1990 to Mar. 1991 toward completion of our project on phylogenetic relationships among subsurface microorganisms. The major accomplishments of the project during this period include: (1) preliminary grouping of SMCC isolates on the basis of 16S rRNA sequence data; (2) design and synthesis of 16S rRNA probes; (3) development of in situ hybridization procedures; (4) relatednes of subsurface isolates to selected phylogenetic groups; (5) RFLP analysis as an indicator of isolates to be tested with in situ hybridization; (6) detection of 16S rRNA in starved cells using SMCC isolates; and (7) preliminary experiments using microbes released from sediment samples, derived from the Hanford site. reflects its metabolic state. Cells which are starved for four days are not detectable with the homologous 16S rRNA probe. However, within 15 minutes of refeeding, detectable rRNA appeared. This suggests that organisms which are undetectable in environmental samples due to starvation may be detectable after addition of nutrients. Stepwise addition of specific nutrients could indicate which nutrients are rate limiting for growth. Preliminary experiments with soil samples from the Hanford Site indicate indigenous microorganisms can be detected by oligionucleotide probes. Further, using multiple probes based on universal sequences increases the number of organisms detected. Double label experiments, using a rhodamine-labelled oligionucleotide probe with free coumarin succinimidyl ester will allow simultaneous detection of total bacteria and specific 16S rRNA containing bacteria. DOE

N91-27724*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, CA.
THE EVOLUTION OF ENERGY-TRANSDUCING SYSTEMS. STUDIES WITH AN EXTREMELY HALOPHILIC ARCHAEBACTERIUM Semiannual Progress Report, Feb. - Jul. 1991
Helga Stan-Lotter Jul. 1991 5 p
(Contract NCC2-578)
(NASA-CR-188641; NAS 1.26:188641) Avail: NTIS HC/MF A01 CSCL 06C

The halobacterial ATPase was labeled with C-14-dicyclohexylcarbodiimide and subunit 2 of the enzyme was prepared by electroelution. Subunit 2 was cleaved by several chemical and enzymatic procedures for further preparation of peptides. Immunoreactions (Western blotting) of halobacterial membranes were performed with an antiserum against subunit A of the vacuolar ATPase from Neurospora crassa. A 85 K band (subunit 1) from the membranes of H saccharovorum and from two halobacterial isolates, which were isolated from Permian salt sediments, reacted strongly with the antiserum. The ATPase from the latter isolates resembled the ATPase from H saccharovorum, but had a higher content of acidic amino acids. If it can be verified that the age of the bacterial isolates is in the same range as when deposition of salt occurred, an extremely interesting system for the study of evolutionary questions would be available, since the salt-embedded bacteria presumably did not undergo mutational and selectional events. Author

N91-27725# Joint Publications Research Service, Arlington, VA.
JPRS REPORT: SCIENCE AND TECHNOLOGY. USSR: LIFE SCIENCES
10 Jan. 1991 32 p Transl. into ENGLISH from various Russian articles
(JPRS-ULS-91-003) Avail: NTIS HC/MF A03

Abstracts of Soviet literature in various areas of the life sciences are compiled. The following subject areas are covered: agricultural science, epidemiology, immunology, medicine, microbiology, pharmacology and toxicology, physiology, and public health. Author

N91-27726# Joint Publications Research Service, Arlington, VA.
JPRS REPORT: SCIENCE AND TECHNOLOGY. USSR: LIFE SCIENCES
7 Feb. 1991 58 p Transl. into ENGLISH from various Russian articles
(JPRS-ULS-91-004) Avail: NTIS HC/MF A04

Abstracts of Soviet literature are presented in the field of life sciences. The following areas are covered: aerospace medicine; agricultural science; biochemistry; biotechnology; genetics; immunology; laser bioeffects; medicine; microbiology; nonionizing radiation effects; pharmacology and toxicology; public health; and radiation biology. For individual titles, see N91-27727 through N91-27733.

N91-27727# Joint Publications Research Service, Arlington, VA.
PSYCHOPHYSIOLOGICAL CHARACTERISTICS OF SENSORIMOTOR ACTIVITY OF OPERATORS AFTER SHORT-TERM SIMULATED WEIGHTLESSNESS Abstract Only
c52
V. A. Ponomarenko, V. V. Lapa, and I. S. Nikitin *In its* JPRS Report: Science and Technology. USSR: Life Sciences 7 Feb. 1991 p 1 Transl. into ENGLISH from Kosmicheskaya Biologiya i Aviakosmicheskaya Meditsina (Moscow, USSR), v. 3, no. 5, Sep. - Oct. 1989 p 9-12 (For primary document see N91-27726 19-51)
Avail: NTIS HC/MF A04

Psychophysiological tests were conducted on operators to assess the effects of weightlessness on sensorimotor efficiency and operational task performance. Weightlessness was simulated by a -10 degree orthostatic position for 6 days, with a pressure suit applying excess pressure of 60 mm Hg to the lower half of the body, and one-day imersion in water. The results demonstrated that after a period of weightlessness, fine motor coordination and performance suffer in the immediate post weightlessness period, which may be a critical factor upon entering the earth's atmosphere after space flight. The deterioration in performance was described as deautomation of learned habits as a result of changes in the functional status of the motor analyzer and proprioception. Deterioration was evident in loss of strength and endurance, as well as in over-estimation of effort required for task completion. In practical terms, these observations indicate that upon re-entering the earth's gravitational field, the pilot's motor activity will be regulated essentially by the second signal level. Accordingly, performance under these conditions may be predicted from evaluation of differential thresholds of proprioceptive sensitivity, and training of space crews should encompass conditions involving distorted proprioception. Author

N91-27728# Joint Publications Research Service, Arlington, VA.
FEATURES OF TERRESTRIAL NIGHTTIME SLEEP OF MONKEYS AND SLEEP DURING SPACE FLIGHT ABOARD COSMOS-1667 BIOSATELLITE Abstract Only
G. G. Shlyk, V. S. Rotenberg, M. A. Shirvinskaya, V. I. Korolkov, and V. S. Magedov *In its* JPRS Report: Science and Technology. USSR: Life Sciences 7 Feb. 1991 p 1 Transl. into ENGLISH from Kosmicheskaya Biologiya i Aviakosmicheskaya Meditsina (Moscow, USSR), v. 3, no. 5, Sep. - Oct. 1989 p 12-17 (For primary document see N91-27726 19-51)
Avail: NTIS HC/MF A04

Nighttime sleep patterns were assessed in two monkeys, Vernyy and Gordyy, under terrestrial conditions and during a seven day flight aboard the Cosmos-1667 biological satellite. Comparison of the electrophysiological data derived during the night immediately before flight, during flight, and one month after the flight showed that the two primates responded differently to the experience. In the case of Vernyy, the most pronounced perturbations in the sleep pattern were noted immediately before the flight, including frequent awakenings and reduction in delta sleep and elevation of the REM/delta sleep ratio. During the first night aboard Cosmos-1667, Vernyy exhibited the recoil effect and had the longest delta sleep seen in that animal during the period of observations. Subsequently, the sleep characteristics stabilized with reduction in the REM/delta sleep ratio, a change indicative of adaptation. A month later, good tolerance of space flight and physiological recovery were evident in low REM/delta sleep ratios and high proportion of delta sleep. The changes observed in the case of Gordyy reflected less capacity for adaptation and tolerance of stress. The maximum increase in the REM/delta sleep ratio was less than 50 percent in Vernyy, but was more than twofold in Gordyy (largely the result of extremely short delta sleep). Furthermore, Gordyy also failed to exhibit the recoil phenomenon. Author

N91-27729# Joint Publications Research Service, Arlington, VA.
STRUCTURAL CHANGES IN VESTIBULAR RECEPTORS IN RATS AFTER FLIGHT ABOARD COSMOS-1667 BIOSATELLITE Abstract Only
D. V. Lychakov, A. N. Pashchinin, A. Byadzhiyeva-Mikhaylova, and I. Khristov *In its* JPRS Report: Science and Technology. USSR: Life Sciences 7 Feb. 1991 p 1 Transl. into ENGLISH from Kosmicheskaya Biologiya i Aviakosmicheskaya Meditsina (Moscow, USSR), v. 3, no. 5, Sep. - Oct. 1989 p 17-26 (For primary document see N91-27726 19-51)
Avail: NTIS HC/MF A04

Light microscopy and ultrastructural studies were conducted on the vestibular structure of 13 male rats, approximately 13 months old, after a seven-day space flight aboard the biosatellite Cosmos-1667. The study represents the first ultrastructural assessment of the utriculus, sacculus, and ampullae of the semicircular canals. The study revealed considerable variation in the receptory epithelium. Receptor cells in the auditory striae of the uticulus and sacculus and in the central apical area of the cristae were found to be surrounded by enlarged cup-like nerve endings that cover approximately 70 percent of the receptor cell surface. The enlarged nerve endings were distributed unevenly in the various vestibular formations and differed between the right

and left ear. Comparison between one rat sacrificed immediately after the flight and those sacrificed later demonstrated that the changes in the nerve endings were evidently due to space flight, since they disappeared on re-adaptation to terrestrial conditions. In conjunction with previously published data, it appears that space flights of 20 days or less do not induce persistent abnormal changes in the receptor components of the vestibular apparatus. Author

N91-27730# Joint Publications Research Service, Arlington, VA.
MINERAL DENSITY OF BONES OF HUMAN SKELETON IN SIMULATED REDUCED GRAVITY Abstract Only **c52**
V. S. Oganov, A. S. Rakhmanov, S. K. Ternovoy, V. Ye. Novikov, and S. L. Dubonos *In its* JPRS Report: Science and Technology. USSR: Life Sciences 7 Feb. 1991 p 2 Transl. into ENGLISH from Kosmicheskaya Biologiya I Aviakosmicheskaya Meditsina (Moscow, USSR), v. 3, no. 5, Sep. - Oct. 1989 p 43-47 (For primary document see N91-27726 19-51)
Avail: NTIS HC/MF A04

Changes in bone density in response to a 370 day regimen of antiorthostatic (-5 degree) hypokinesia were studied in nine men, 27 to 41 years old, four of whom (Group A) engaged in physical exercise throughout the experiment, and five of whom (Group B) were started on physical exercise beginning with day 120. Data derived from a variety of noninvasive techniques demonstrated to a decrease in density of lumbar vertebrae, diaphyses of the femur, tibia, and forearm bones in most of the subjects with considerable individual variability. The changes, however, were less pronounced in the initial stages in subjects on continuous training. Furthermore, calcium losses from the diaphyses were rather limited and were usually less than 1 percent per month. The most pronounced changes were in the density of the femoral neck, which may be used as an indicator of calcium loss under these conditions. Initiation of physical exercise at day 120 prevented further calcium loss from the femoral neck in Group B, but did not lead to reversal. Author

N91-27731# Joint Publications Research Service, Arlington, VA.
BLOOD SERUM PROTEIN COMPOSITION AND NITROGEN METABOLISM METABOLISM IN INDIVIDUALS EXPOSED TO LENGTHY HYPOKINESIA Abstract Only **c52**
L. B. Zaytseva, O. N. Larina, and I. A. Popova *In its* JPRS Report: Science and Technology. USSR: Life Sciences 7 Feb. 1991 p 2 Transl. into ENGLISH from Kosmicheskaya Biologiya I Aviakosmicheskaya Meditsina (Moscow, USSR), v. 3, no. 5, Sep. - Oct. 1989 p 50-54 (For primary document see N91-27726 19-51)
Avail: NTIS HC/MF A04

In order to obtain a better understanding of factors affecting human physiology under space flight conditions, nine men 27 to 42 years old were subjected to 370 days of orthostatic hypokinesia at an angle of -5 degrees. Physical exercise and chemotherapeutic measures intended to mitigate the adverse effects of hypokinesia were implemented in one group (Group A) of four men on day 25, and in the remaining five subjects on day 120 (Group B). The monitoring of serum protein patterns and urea, uric acid, and creatinine levels, in conjunction with urine levels of uric acid and creatinine, demonstrated, for the most part, little deviation from control values. However, urine creatinine levels revealed predominance of catabolic processes in the muscle tissues, and depression of serum alpha(sub 2)-globulins reflected depression of hepatic biosynthetic potential. Elevation of beta-gobulins in both groups indicated an increase in serum concentration of low-density lipoproteins. The urinary creatinine levels in Group A individuals remained normal for approximately 170 days, but thereafter rose to the unfavorable high level seen in Group B subjects. Author

N91-27732# Joint Publications Research Service, Arlington, VA.
FUNCTIONAL TESTING DURING YEARLONG ANTIORTHOSTATIC HYPOKINESIA Abstract Only **c52**
V. M. Mikhaylov, G. V. Machinskiy, V. P. Buzulina, V. S. Georgiyevskiy, E. N. Nechayeva, and S. G. Kryutchenko *In its* JPRS Report: Science and Technology. USSR: Life Sciences 7 Feb. 1991 p 2 Transl. into ENGLISH from Kosmicheskaya Biologiya I Aviakosmicheskaya Meditsina (Moscow, USSR), v. 3, no. 5, Sep. - Oct. 1989 p 54-56 (For primary document see N91-27726 19-51)
Avail: NTIS HC/MF A04

Cardiorespiratory functional testing and work performance were assessed in nine men subjected to 370 days of antiorthostatic (-4.5 degree) hypokinesia. The study was designed to monitor the efficacy of countermeasures employed against weightlessness aboard the Mir Space Station. The results demonstrated that the adverse effects of weightlessness were subject to mitigation by a regular schedule of physical exercise similar, in effect, to that on the Mir Space Station. The beneficial effects were particularly pronounced in the four subjects who were on the exercise regimen throughout the period of simulated weightlessness; they were less so in the five subjects whose exercise program was delayed for 120 days. The former group, for example, remained free of syncopal episodes while the latter group did not. Author

N91-27733# Joint Publications Research Service, Arlington, VA.
REASONS FOR INFLIGHT DETERIORATION OF STATE OF HEALTH IN PILOTS. REPORT 2 Abstract Only **c52**
V. Ye. Yastrebov and V. V. Shcherbinskiy *In its* JPRS Report: Science and Technology. USSR: Life Sciences 7 Feb. 1991 p 3 Transl. into ENGLISH from Voyenno-Meditsinskiy Zhurnal (Moscow, USSR), no. 10, Oct. 1989, p 43-45 (For primary document see N91-27726 19-51)
Avail: NTIS HC/MF A04

The second part of a report is presented on factors underlying inflight deterioration of health in pilots, usually described in the literature as fatigue related to mental and physical stress. Current findings indicate that the physiological changes implicated in this condition are vagotonia, spasmophilia, and functional hypoglycemia. Equally significant is the fact that psychological factors are involved in 55 to 85 percent of the cases, in conjunction with physical stress factors. Although greater insight was obtained into the pathogenetic mechanisms underlying inflight deterioration of physical and mental faculties, prevention and treatment modalities will have to be placed on a firmer ground through further research to ensure greater flight safety. Author

N91-27734# Joint Publications Research Service, Arlington, VA.
JPRS REPORT: SCIENCE AND TECHNOLOGY. USSR: LIFE SCIENCES
15 Mar. 1991 33 p Transl. into ENGLISH from various Russian articles
(JPRS-ULS-91-007) Avail: NTIS HC/MF A03

Topics addressed include: biochemistry; biotechnology; epidemiology; public health; virology; laser bioeffects; environment; radiation biology; medicine; physiology; immunology; microbiology; pharmacology; non-ionizing radiation effects; and toxicology. B.G.

N91-27735# Joint Publications Research Service, Arlington, VA.
JPRS REPORT: SCIENCE AND TECHNOLOGY. USSR: LIFE SCIENCES
17 Jun. 1991 77 p Transl. into ENGLISH from various Russian articles
(JPRS-ULS-91-013) Avail: NTIS HC/MF A05

Abstracts of Soviet research projects in the life sciences are presented. The following topics are covered: biophysics, public health, radiation biology, and biotechnology. K.S.

N91-27736# Joint Publications Research Service, Arlington, VA.
JPRS REPORT: SCIENCE AND TECHNOLOGY. USSR: LIFE SCIENCES
28 Jun. 1991 53 p Transl. into ENGLISH from various Russian articles
(JPRS-ULS-91-014) Avail: NTIS HC/MF A04

Abstracts on U.S.S.R. research in life sciences are given. Topics covered include biochemistry, biophysics, epidemiology, clinical medicine, microbiology, pharmacology, physiology, public health, psychology, radiation biology, and virology. Author

N91-27737# Arizona Univ., Tucson.
PROCEEDINGS OF THE 4TH INTERNATIONAL SYMPOSIUM ON BIOLOGICAL REACTIVE INTERMEDIATES: MOLECULAR AND CELLULAR EFFECTS AND THEIR IMPACT ON HUMAN HEALTH Final Report, 15 Feb. 1990 - 14 Feb. 1991
I. G. Sipes 3 Apr. 1991 16 p Symposium held in Tucson, AZ, 14-17 Jan. 1990
(Grant AF-AFOSR-0186-90; AF Proj. 2312)
(AD-A235518; AFOSR-91-0441TR) Avail: NTIS HC/MF A03 CSCL 15/6

The topics of each session focused on understanding new developments in the area of formation/detoxification of reactive intermediated and the consequence of their formation. The program consisted of 71 major talks, a Round Table Discussion and 108 free communications (posters). The nature of the presentations underscored the need to understand the molecular and cellular consequence of reactive intermediate formation. The final talk focused on new approaches and research needs in the area of reactive intermediates. The 'Future Research Needs for the Application of Mechanistic Data to Risk Assessment' talk focused on how modern molecular biology tools can be incorporated into mechanistic studies. GRA

N91-27738# Brown Univ., Providence, RI. Center for Neural Science.
SYNAPTIC PLASTICITY IN VISUAL CORTEX: COMPARISON OF THEORY WITH EXPERIMENT
Eugene E. Clothiaux, Mark F. Bear, and Leon N. Cooper 1990 71 p
(Contracts N00014-86-K-0041; DAAL03-88-K-0116; NSF EET-87-19102; NSF DIR-87-20084)
(AD-A236223) Avail: NTIS HC/MF A04 CSCL 20/4

Experiments performed over the last three decades indicate that the response properties of neurons in the striate cortex of the cat can be modified by manipulating the visual experience of the animal during a critical period of postnatal development. A theory that can account for these results in a precise, quantitative fashion may yield insight into the underlying molecular mechanisms as well as make possible the use of the visual cortex as a preparation for the study of the physiological basis of learning and memory storage. Such a theory has been developed in our laboratory. It allows a precise specification of theoretical equivalents of experimental situations and makes possible detailed and quantitative comparison of theory with experiment. The aim of the present effort is to provide such a comparison for what we call classical rearing conditions. These include normal rearing, monocular deprivation, reverse suture, strabismos, binocular deprivation, as well as the restoration of normal binocular vision after forms of deprivation. We find quantitative agreement of theory and experiment both for equilibrium states and the kinetics by which they are reached. GRA

N91-27739# California Univ., Santa Barbara. Marine Science Inst.
MOLECULAR BIOLOGY OF THE PHOTOREGULATION OF PHOTOSYNTHETIC LIGHT-HARVESTING COMPLEXES IN MARINE DINOFLAGELLATES Final Report, Oct. 1987 - Mar. 1991
Barbara B. Prezelin and Edward L. Triplett 4 Jun. 1991 5 p
(Contract N00014-88-K-0060; NR Proj. RR0-4106)
(AD-A236623) Avail: NTIS HC/MF A01 CSCL 06/1

The goal is to continue to use biotechnological techniques to study the genetic bases of light- and nutrient-regulation of photosynthetic light-harvesting complexes in marine dinoflagellates. The peridinin chlorophyll a-protein (PCP) complexes of dinoflagellates was chosen as a model system for proposed genetic analyses. Since these phytoplankton are a spectral representative of the large group of marine algae whose light-harvesting components are dominated by blue-light absorbing xanthophylls, knowledge gained through study of the PCP system may also provide insights into the closely related fucoxanthin system of diatoms, chrysophytes and brown algae. GRA

N91-28064*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, CA.
A COMPARATIVE STUDY OF SEMINIFEROUS TUBULAR EPITHELIUM FROM RATS FLOWN ON COSMOS 1887 AND SL3
Walter J. Sapp, Carol S. Williams, K. Kato, Delbert E. Philpott, J. Stevenson, and L. V. Serova (Institute of Biomedical Problems, Moscow, USSR) *In* Alabama A & M Univ., NASA-HBCU Space Science and Engineering Research Forum Proceedings 1989 p 1-8 Submitted for publication Sponsored in part by NIH (For primary document see N91-28063 19-99)
(Contracts NCC2-12; NCC2-455)
Avail: NTIS HC/MF A23 CSCL 06C

N91-28065*# Tuskegee Inst., AL. Agricultural Experiment Station.
EFFECT OF BIWEEKLY SHOOT TIP HARVESTS ON THE GROWTH AND YIELD OF GEORGIA JET SWEET POTATO GROWN HYDROPONICALLY
Cyriacus R. Ogbuehi, Phil A. Loretan, C. K. Bonsi, Walter A. Hill, Carlton E. Morris, P. K. Biswas, and Desmond G. Mortley *In* Alabama A & M Univ., NASA-HBCU Space Science and Engineering Research Forum Proceedings 1989 p 9-14 Sponsored in part by Department of Agriculture (For primary document see N91-28063 19-99)
(Grant NAG10-24)
Avail: NTIS HC/MF A23 CSCL 06C

N91-28066*# Tuskegee Inst., AL. Agricultural Experiment Station.
EFFECT OF CHANNEL SIZE ON SWEET POTATO STORAGE ROOT ENLARGEMENT IN THE TUSKEGEE UNIVERSITY HYDROPONIC NUTRIENT FILM SYSTEM
Carlton E. Morris, Edwin Martinez, C. K. Bonsi, Desmond G. Mortley, Walter A. Hill, Cyriacus R. Ogbuehi, and Phil A. Loretan *In* Alabama A & M Univ., NASA-HBCU Space Science and Engineering Research Forum Proceedings 1989 p 15-19 Sponsored in part by Department of Agriculture (For primary document see N91-28063 19-99)
(Grant NAG10-24)
Avail: NTIS HC/MF A23 CSCL 06C

N91-28069*# Alcorn State Univ., Lorman, MS. Dept. of Biological Sciences.
IN VITRO REGENERATION OF BASELLA ALBA L
Norris Allen Edney, Muhammad A. Rizvi, and Narjis F. Rizvi *In* Alabama A & M Univ., NASA-HBCU Space Science and Engineering Research Forum Proceedings 1989 p 33-39 (For primary document see N91-28063 19-99)
Avail: NTIS HC/MF A23 CSCL 06C

N91-28070*# Alabama A & M Univ., Normal. Dept. of Biology.
MANIPULATING CYANOBACTERIA: SPIRULINA FOR POTENTIAL CELSS DIET
Mahasin G. Tadros, Woodrow Smith, Peter Mbuthia, and Beverly Joseph *In* Alabama A & M Univ., NASA-HBCU Space Science and Engineering Research Forum Proceedings 1989 p 40-44 (For primary document see N91-28063 19-99)
(Contract NCC2-501)
Avail: NTIS HC/MF A23 CSCL 06C

52 AEROSPACE MEDICINE

Includes physiological factors; biological effects of radiation; and effects of weightlessness on man and animals.

N91-27740# Joint Publications Research Service, Arlington, VA.
JPRS REPORT: SCIENCE AND TECHNOLOGY. USSR: LIFE SCIENCES
13 Nov. 1990 63 p Transl. into ENGLISH from various Russian articles
(JPRS-ULS-90-019) Avail: NTIS HC/MF A04

This is a compilation of translated Russian articles from various

publications. They are grouped into the following subject areas: Aerospace medicine; Agricultural science; Biochemistry; Biophysics; Biotechnology; Epidemiology; Genetics; Laser bioeffects; Microbiology; Military medicine; Nonionizing radiation effects; and Public health. Two abstracts are presented elsewhere: Effect of Job Load on Functional State of Naval Flight Personnel and Pathogenesis and Prevention of Pain Syndrome in Pilots on Long Flights. For individual titles, see N91-27741 through N91-27742.

N91-27741# Joint Publications Research Service, Arlington, VA.
EFFECT OF JOB LOAD ON FUNCTIONAL STATE OF NAVAL FLIGHT PERSONNEL Abstract Only
S. G. Melnik, A. V. Shakula, and F. D. Gladkikh *In its* JPRS Report: Science and Technology. USSR: Life Sciences 13 Nov. 1990 p 1 Transl. into ENGLISH from Voyenno-Meditsinskiy Zhurnal (Moscow, USSR), no. 7, Jul. 1989 p 54-57 (For primary document see N91-27740 19-52)
Avail: NTIS HC/MF A04

Comparative studies were conducted on the cardiovascular and respiratory effects that low and high latitude flights have on naval helicopter crews. Data derived for 26 crew members showed that at low latitudes, because of high temperatures and other climatic factors, 2 to 3.5 hours of flight activity were much more stressful than at higher latitudes. Whereas at higher latitudes recovery of normal cardiovascular and respiratory status required about 16 hours, at low latitudes recovery continued for more than 58 hours. As expected, the adverse effects of a 3.5 hour flight were more pronounced than those of a 2 hour flight. These findings indicate that flight time should be limited to 2.5 to 3 hours, with no more than 2 to 3 flights per day. In addition, sea duty should be limited to a maximum of two tours of three months each. Author

N91-27742# Joint Publications Research Service, Arlington, VA.
PATHOGENESIS AND PREVENTION OF PAIN SYNDROME IN PILOTS ON LONG FLIGHTS Abstract Only
V. A. Varfolomeyev *In its* JPRS Report: Science and Technology. USSR: Life Sciences 13 Nov. 1990 p 1 Transl. into ENGLISH from Voyenno-Meditsinskiy Zhurnal (Moscow, USSR), no. 8, Aug. 1989 p 46-48 (For primary document see N91-27740 19-52)
Avail: NTIS HC/MF A04

An analysis was conducted on the pain syndrome that afflicts flight crews during long flights and on the means that may be used to prevent or minimize the discomfort. Basically, the syndrome consists of pain commencing in the lumbar region and after 5 hours, spreading to the back and then, after 10 to 13 hours, affecting the neck, shoulders, feet, and all the major muscle groups. Key factors leading to the development of in-flight pain on prolonged flights are tissue compression, hypodynamic tone, body position, mental and muscle fatigue, and static stress on muscles. Mitigation of the pain syndrome involves physical conditioning as well as physical exercise and various forms of massage, hydrotherapy, and so forth. In-flight measures involve physical activity which, in addition to toning the body, also has the beneficial effect of maintaining wakefulness and alertness. Author

N91-27743# AScI Corp., McLean, VA.
TOTAL HUMAN EXPOSURE AND INDOOR AIR QUALITY: AN AUTOMATED BIBLIOGRAPHY (BLIS) WITH SUMMARY ABSTRACTS, VOLUME 2 Final Report, Jan. 1987 - Dec. 1989
M. Dellarco and W. Ott Oct. 1990 139 p
(Contract EPA-68-D9-0094)
(PB91-137281) Avail: NTIS HC/MF A07 CSCL 06P

The Bibliographical Literature Information System (BLIS) is a computer data base that provides a comprehensive review of available literature on total human exposure to environmental pollution. Brief abstracts (often condensed versions of the original abstracts) are included; if the original document had no abstract, one was prepared. Unpublished draft reports are listed, as well as final reports of the U.S. Government and other countries, reports by governmental research contractors, journal articles, and other publications on exposure models field data, and newly emerging research methodologies. Emphasis on those field studies measuring all the concentrations to which people may be exposed, including indoors, outdoors, and in-transit. Author

N91-27744# Joint Publications Research Service, Arlington, VA.
JPRS REPORT: SCIENCE AND TECHNOLOGY. USSR: LIFE SCIENCES
9 Jan. 1991 84 p Transl. into ENGLISH from various Russian articles
(JPRS-ULS-91-002) Avail: NTIS HC/MF A05

Abstracts of Soviet literature in various areas of the life sciences are compiled. The following subject areas are covered: agriculture, aerospace medicine, biochemistry, biotechnology, epidemiology, genetics, immunology, laser biological effects, medical science, microbiology, molecular biology, nonionizing radiation effects, pharmacology and toxicology, physiology, public health, and virology. For individual titles, see N91-27745 through N91-27751.

N91-27745# Joint Publications Research Service, Arlington, VA.
THE 370-DAY ANTIORTHOSTATIC HYPOKINESIA: GOALS AND PROTOCOLS
A. I. Grigoryev and B. V. Morukov *In its* JPRS Report: Science and Technology. USSR: Life Sciences 9 Jan. 1991 p 1-3 Transl. into ENGLISH from Kosmicheskaya Biologiya i Aviakosmicheskaya Meditsina, Moscow (USSR), v. 23, no. 5, Sep.-Oct. 1989 p 47-50 (For primary document see N91-27744 19-52)
Avail: NTIS HC/MF A05

The purpose of research on 370-day antiorthostatic hypokinesia was to improve the complex of preventive measures that are designed for use during long space flights. The main objectives were: (1) to improve the physical conditioning system; (2) to study the effectiveness of pharmaceutical preparations that avert metabolic changes in tissues of the locomotor system, to study metabolism, and to ensure an adequate level of energetic and plastic processes during times of intensive physical conditioning; and (3) to assess the effectiveness of means for day-to-day correction for hemodynamic shifts and hydro-ionic homeostasis. Author

N91-27746# Joint Publications Research Service, Arlington, VA.
ORTHOSTATIC STABILITY OF DEHYDRATED HEALTHY MEN Abstract Only
V. B. Noskov, A. N. Kotov, M. Yu. Volkov, O. N. Rustamyan, Yu. V. Sukhanov, and K. S. Yurova *In its* JPRS Report: Science and Technology. USSR: Life Sciences 9 Jan. 1991 p 48 Transl. into ENGLISH from Fiziologiya Cheloveka, Moscow (USSR), v. 16, no. 1, Jan.-Feb. 1990 p 112-117 (For primary document see N91-27744 19-52)
Avail: NTIS HC/MF A05

An analysis was conducted on the impact of dehydration induced by 80 mg of furosemide on orthostatic stability and reactivity of cardiopulmonary and endocrine systems. The standard 20 min orthostatic test was performed on ten men. Hemodynamic monitoring, blood chemistries and urinanalysis demonstrated that the response of the cardiopulmonary system was dependent on the degree of hypovolemia as well as individual neuroendocrine reactivity. The results demonstrated that a 7 to 20 percent hypovolemia was tolerable without onset of orthostatic instability due to adequate mobilization of neuroendocrine reserves. The response of the renin-angiotensin-aldosterone axis with that degree of hypovolemia ensured sufficient vacular tone to preclude postular instability. Author

N91-27747# Joint Publications Research Service, Arlington, VA.
PHYSIOLOGICAL SEQUELAE OF VOLUNTARY BREATH HOLDiNG Abstract Only
V. B. Malkin and Ye. P. Gora *In its* JPRS Report: Science and Technology. USSR: Life Sciences 9 Jan. 1991 p 48 Transl. into ENGLISH from Fiziologiya Cheloveka, Moscow (USSR), v. 16, no. 1, Jan.-Feb. 1990 p 118-126 (For primary document see N91-27744 19-52)
Avail: NTIS HC/MF A05

In view of the importance of breath holding tests in assessing

occupational stability of cosmonauts, pilots and underwater divers, an analysis was conducted on individual responsiveness of the cardiopulmonary system, oxygen saturation of the blood and the CNS to voluntary inspirational and expirational breath holding. Phase studies demonstrated that individual variability in the time required for incoordination of the respiratory musculature. Author

N91-27748# Joint Publications Research Service, Arlington, VA.
ACID-BASE BALANCE IN MEN BREATHING AIR WITH RAISED CO2 Abstract Only
I. A. Sapov, V. I. Kuleshov, I. V. Levshin, and Yu. Yu. Keyerig *In its* JPRS Report: Science and Technology. USSR: Life Sciences 9 Jan. 1991 p 48 Transl. into ENGLISH from Fiziologiya Cheloveka, Moscow (USSR), v. 16, no. 1, Jan.-Feb. 1990 p 127-132 (For primary document see N91-27744 19-52)
Avail: NTIS HC/MF A05

The effects of different levels of CO2 in inspired air on acid-base balance were studied in 34 men, subjected to 3.5, 4.5 or 5.5 percent CO2 for 72, 42 or 22 h, respectively. Oxygen was maintained at 17 to 18 percent. Hypercapnia was most pronounced in the 5.5 percent CO2 group, with the arterial pH falling to 7.322 and venous pH to 7.252 and the corresponding pCO2 values raising to 6.7 and 8.41 kPa, respectively. Accordingly, this group was felt to be most at risk of hemic hypoxia and metabolic acidosis, indicating that exposure to 5.5 percent CO2 for 22 h represents a critical situation in closed systems, such as prevails in space ships. Author

N91-27749# Joint Publications Research Service, Arlington, VA.
EFFECTS OF WORK AND RAISED CO2 COMBINATION ON RESPIRATION AND THERMOREGULATION Abstract Only
S. V. Levinskiy and I. I. Malkiman *In its* JPRS Report: Science and Technology. USSR: Life Sciences 9 Jan. 1991 p 48-49 Transl. into ENGLISH from Fiziologiya Cheloveka, Moscow (USSR), v. 16, no. 1, Jan.-Feb. 1990 p 133-140 (For primary document see N91-27744 19-52)
Avail: NTIS HC/MF A05

An assessment was conducted on the effects of physical exertion (57 W for 20 min) and raised ambient CO2 (5-6 percent) on respiration and thermoregulation. The study encompassed 8 men, subjected to 5-6 percent CO2 for 4 h/day for three days with and without physical work. Quantitative information was derived from pulmonary function studies and measurement of rectal temperature. The results led to classification of the subjects into three types: (1) individuals exhibited considerable tolerance of oxygen debt and maintained or actually increased body temperature on exertion; (2) subjects were characterized by inadequate adaptation to elevated CO2 and inability to maintain body temperature at a normal level; and subjects showed the greatest fall in body temperature and, obviously, were least tolerant of raised CO2. Author

N91-27750# Joint Publications Research Service, Arlington, VA.
EFFECT OF AMINAZINE ON FUNCTIONAL STATE OF CARDIOVASCULAR SYSTEM DURING HYPERTHERMIA Abstract Only
V. A. Tashliyev, K. A. Amannepesov, A. O. Kafurov, and A. N. Ulitin *In its* JPRS Report: Science and Technology. USSR: Life Sciences 9 Jan. 1991 p 51 Transl. into ENGLISH from Izvestiyaa Akademii Nauk Turkmenskoy SSR: Seriya Biologicheskikh Nauk, Ashkhabad (USSR), no. 5, Sep.-Oct. 1989 p 59-65 (For primary document see N91-27744 19-52)
Avail: NTIS HC/MF A05

Examination of effector manifestations of the cardiovascular system during hyperthermic stress and observation of their changes after the use of aminazine and a comparison and analysis of hemodynamic, thermometric, and chronometric data included 2 series of experiments on unanesthesized rats. Both series (experimental and control) involved measurement of rheographic parameters, arterial pressure, rectal temperature, and determination of length of survival after hyperthermia. Recording of these indicators for 60-70 min at 10-min intervals at normal temperatures preceded a temperature increase to 45 C and subcutaneous injection of aminazine at a rate of 125 mg to 100 g of weight of the animal. Author

N91-27751# Joint Publications Research Service, Arlington, VA.
BIOLOGICAL EXPERIMENTS ON KOSMOS-1887 BIOSATELLITE c53
A. M. Alpatov, Ye. A. Ilin, V. V. Antipov, and M. G. Tairbekov *In its* JPRS Report: Science and Technology. USSR: Life Sciences 9 Jan. 1991 p 68-72 Transl. into ENGLISH from Kosmicheskaya Biologiya i Aviakosmicheskaya Meditsina, Moscow (USSR), v. 23, no. 5, Sep.-Oct. 1989 p 26-32 (For primary document see N91-27744 19-52)
Avail: NTIS HC/MF A05

The Kosmos-1887 satellite is a specialized biosatellite, designed to accommodate biomedical research conducted during the flight. Diverse organisms were on board: bacteria, protozoans, plants, worms, insects, fish, and amphibians. The research on those biological subjects was geared toward further study of the biological effects of weightlessness, evaluation of the fundamental consequences of the loss of gravity, and the refinement of the ideas on the biological role of gravity. The program of biological experiments included a number of traditional areas: cell biology, genetics, and biological development. A new area was also added - biorhythmology. A brief, general survey of the basic results of those experiments is presented. Author

N91-27752# David Sarnoff Research Center, Princeton, NJ.
EXPERIMENTAL SYSTEM FOR THE NONINVASIVE DETECTION OF AIR BUBBLES IN TISSUES Final Report, Mar. 1987 - Dec. 1988
Robert W. Paglione Dec. 1990 11 p
(Contract F33615-87-C-0608)
(AD-A235458; USAFSAM-TP-90-18) Avail: NTIS HC/MF A03 CSCL 06/10

The air-bubble detection system was designed to detect the changes in the microwave absorption properties of tissues. These changes could be caused by the introduction of air bubbles due to exposure to high altitudes. The system basically transmits a low-level modulated microwave signal through the tissue and monitors the changes in the amplitude of the received signal. The output signal from the detection circuitry can be monitored using an oscilloscope or strip-chart recorder. The system is powered by + or - 8V and +12V DC. The DC voltages are generated from the AC line using a standard AC/DC supply and post-regulators. This assembly is housed in a separate enclosure that is electrically isolated from the microwave enclosure. GRA

N91-27753# Chicago Univ., IL. Dept. of Medicine.
PHASE-SHIFTING EFFECT OF LIGHT AND ACTIVITY ON THE HUMAN CIRCADIAN CLOCK Annual Technical Report, 1 Mar. 1990 - 28 Feb. 1991
Eve VanCauter 1 Apr. 1991 17 p
(Grant AF-AFOSR-0222-90; DA Proj. 2312)
(AD-A235615) Avail: NTIS HC/MF A03 CSCL 06/5

To determine whether single presentation of light or physical activity can phase shift the human circadian clock, 8 young male subjects were subjected to the following experimental protocol. Following entrainment to a fixed sleep wake and light-dark cycle for one week, each subject underwent 3 separate studies: one baseline study in which measurements of circadian phase positions were performed under 'constant routine' conditions (i.e., constant wakefulness in recumbent position under constant dim light with constant caloric intake for 42 hrs), and two studies in which each subject was exposed to a 3-h session of either bright light (5000 Lux) or physical activity (exercise on a stationary arm-and-leg exerciser) during the 'constant routine' regimen. In order to estimate accurately circadian phase positions, 8 overt rhythms were monitored in each subject: plasma cortisol, plasma TSH, plasma melatonin, plasma glucose, plasma C-peptide, core temperature, total activity and mental performance. The immediate phase shifting effects of bright light or exercise were measured on the monitored rhythms on the first day following stimulus presentation. Preliminary

analysis of currently available data indicate that both light and exercise resulted in a phase advance of approximately one hour.
GRA

N91-27754# University of South Alabama, Mobile.
SUPERCOMPUTING AND THE PROCESSING OF ACOUSTIC TRANSIENTS BY BIOLOGICAL SYSTEMS AND MACHINES Final Report
Charles H. Brown 29 Sep. 1990 18 p
(Grant AF-AFOSR-0265-89; AF Proj. 3842)
(AD-A235759; AFOSR-91-0476TR) Avail: NTIS HC/MF A03 CSCL 20/1

Funds were received for the acquisition of scientific instrumentation chosen to strengthen the auditory research program in the Comparative Hearing Laboratory directed. Funds were used to purchase two commercial, research grade, sound booths, and for a computer network based on the 80486 microprocessor. This equipment is dedicated (1) to the laboratory control of psychoacoustical experiments, (2) to the efficient conduction of signal processing analyses suitable for processing on microcomputers, and (3) to serving as a high-speed file server and terminal for the conduction of large-scale signal processing analyses executed on the Alabama Supercomputer Network (Cray XMP-24).
GRA

N91-27755# Naval Medical Research Inst., Bethesda, MD.
COMPUTER-BASED TECHNIQUES FOR COLLECTION OF PULMONARY FUNCTION VARIABLES DURING REST AND EXERCISE Technical Report, Jan. - Dec. 1990
Nigel A. Taylor and John R. Clarke Mar. 1991 77 p
(NMRI Proj. M00-99)
(AD-A236482; NMRI-91-26) Avail: NTIS HC/MF A05 CSCL 06/5

Pulmonary function tests are routinely included as part of the experimental protocol for both immersion and barophysiology experiments. Typically, these tests are performed using standard spirometry, and as such suffer from time consuming data analysis and experimental error associated with such analysis. In many cases the combined effects of these limitations has meant that some valuable data often fails to come out in the analysis. One solution to this situation is to transfer these tasks to the computer. A computer based system was developed for both data collection and analysis, which is faster, more sensitive to minor physiological perturbations, and more precise than standard spirometry. The apparatus and programming algorithms for this system are presented so that other laboratories might be able to similarly improve the methods for collection of pulmonary function data.
GRA

N91-27756* National Aeronautics and Space Administration, Washington, DC.
AEROSPACE MEDICINE AND BIOLOGY: A CONTINUING BIBLIOGRAPHY WITH INDEXES (SUPPLEMENT 351)
Jul. 1991 92 p
(NASA-SP-7011(351); NAS 1.21:7011(351)) Avail: NTIS HC A03; NTIS standing order as PB89-912300, $10.50 domestic, $21.00 foreign CSCL 06E

This bibliography lists 255 reports, articles and other documents introduced into the NASA Scientific and Technical Information System during Jun. 1991. Subject coverage includes: aerospace medicine and psychology, life support systems and controlled environments, safety equipment, exobiology and extraterrestrial life, and flight crew behavior and performance.
Author

N91-27757# National Inst. of Standards and Technology, Gaithersburg, MD. Office Systems Engineering Group.
GOVERNMENT DOCUMENT PROCESSING REQUIREMENTS REPORT
R. F. Sies Apr. 1991 16 p
(PB91-187773; NISTIR-4560) Avail: NTIS HC/MF A03 CSCL 05B

Several activities are described of the Office Systems Engineering Group in the area of electronic publishing standards. An account is given of the July 30, 1990 workshop on Electronic Information Exchange Standards Used in Document Processing Applications and the list of User Requirements that came out of that workshop. Other efforts are reported which were made to help bring about the harmonization of electronic publishing standards.
Author

N91-27727# Joint Publications Research Service, Arlington, VA.
PSYCHOPHYSIOLOGICAL CHARACTERISTICS OF SENSORIMOTOR ACTIVITY OF OPERATORS AFTER SHORT-TERM SIMULATED WEIGHTLESSNESS Abstract Only
V. A. Ponomarenko, V. V. Lapa, and I. S. Nikitin *In its* JPRS Report: Science and Technology. USSR: Life Sciences 7 Feb. 1991 p 1 Transl. into ENGLISH from Kosmicheskaya Biologiya I Aviakosmicheskaya Meditsina (Moscow, USSR), v. 3, no. 5, Sep. - Oct. 1989 p 9-12 (For primary document see N91-27726 19-51)
Avail: NTIS HC/MF A04

N91-27730# Joint Publications Research Service, Arlington, VA.
MINERAL DENSITY OF BONES OF HUMAN SKELETON IN SIMULATED REDUCED GRAVITY Abstract Only
V. S. Oganov, A. S. Rakhmanov, S. K. Ternovoy, V. Ye. Novikov, and S. L. Dubonos *In its* JPRS Report: Science and Technology. USSR: Life Sciences 7 Feb. 1991 p 2 Transl. into ENGLISH from Kosmicheskaya Biologiya I Aviakosmicheskaya Meditsina (Moscow, USSR), v. 3, no. 5, Sep. - Oct. 1989 p 43-47 (For primary document see N91-27726 19-51)
Avail: NTIS HC/MF A04

N91-27731# Joint Publications Research Service, Arlington, VA.
BLOOD SERUM PROTEIN COMPOSITION AND NITROGEN METABOLISM METABOLISM IN INDIVIDUALS EXPOSED TO LENGTHY HYPOKINESIA Abstract Only
L. B. Zaytseva, O. N. Larina, and I. A. Popova *In its* JPRS Report: Science and Technology. USSR: Life Sciences 7 Feb. 1991 p 2 Transl. into ENGLISH from Kosmicheskaya Biologiya I Aviakosmicheskaya Meditsina (Moscow, USSR), v. 3, no. 5, Sep. - Oct. 1989 p 50-54 (For primary document see N91-27726 19-51)
Avail: NTIS HC/MF A04

N91-27732# Joint Publications Research Service, Arlington, VA.
FUNCTIONAL TESTING DURING YEARLONG ANTIORTHOSTATIC HYPOKINESIA Abstract Only
V. M. Mikhaylov, G. V. Machinskiy, V. P. Buzulina, V. S. Georgiyevskiy, E. N. Nechayeva, and S. G. Kryutchenko *In its* JPRS Report: Science and Technology. USSR: Life Sciences 7 Feb. 1991 p 2 Transl. into ENGLISH from Kosmicheskaya Biologiya I Aviakosmicheskaya Meditsina (Moscow, USSR), v. 3, no. 5, Sep. - Oct. 1989 p 54-56 (For primary document see N91-27726 19-51)
Avail: NTIS HC/MF A04

N91-27733# Joint Publications Research Service, Arlington, VA.
REASONS FOR INFLIGHT DETERIORATION OF STATE OF HEALTH IN PILOTS. REPORT 2 Abstract Only
V. Ye. Yastrebov and V. V. Shcherbinskiy *In its* JPRS Report: Science and Technology. USSR: Life Sciences 7 Feb. 1991 p 3 Transl. into ENGLISH from Voyenno-Meditsinskiy Zhurnal (Moscow, USSR), no. 10, Oct. 1989, p 43-45 (For primary document see N91-27726 19-51)
Avail: NTIS HC/MF A04

N91-28067*# Morgan State Univ., Baltimore, MD. Dept. of Physics.
EXCIMER LASER INTERACTION WITH DENTIN OF THE HUMAN TOOTH
Ernest C. Hammond, Jr., Ruth L. Gilliam, and George R. Baker (Xavier Univ. of Louisiana, New Orleans.) *In* Alabama A & M Univ., NASA-HBCU Space Science and Engineering Research Forum Proceedings 1989 p 21-25 (For primary document see N91-28063 19-99)
Avail: NTIS HC/MF A23 CSCL 06P

N91-28072*# Alabama A & M Univ., Normal. Dept. of Biology.
X RAY SENSITIVITY OF DIPLOID SKIN FIBROBLASTS FROM PATIENTS WITH FANCONI'S ANEMIA Abstract Only
Ranjini Kale *In* Alabama A & M Univ., NASA-HBCU Space Science and Engineering Research Forum Proceedings 1989 p 46 (For primary document see N91-28063 19-99)
Avail: NTIS HC/MF A23 CSCL 06P

N91-28083*# Miles Coll., Birmingham, AL.
THE 3-(BROMOACETAMIDO)-PROPYLAMINE HYDROCHLORIDE: A NOVEL SULFHYDRYL REAGENT AND ITS FUTURE POTENTIAL IN THE CONFIGURATIONAL STUDY OF S1-MYOSIN
Prasanta Sharma and Herbert C. Cheung (Alabama Univ., Birmingham.) *In* Alabama A & M Univ., NASA-HBCU Space Science and Engineering Research Forum Proceedings 1989 p 127-13 (For primary document see N91-28063 19-99)
(Grant NIH-AR-31239)
Avail: NTIS HC/MF A23 CSCL 06P

53 BEHAVIORAL SCIENCES

Includes psychological factors; individual and group behavior; crew training and evaluation; and psychiatric research.

N91-27758# University of Central Florida, Orlando.
TAXONOMIC TRANSFORMATIONS OF VISUAL MEDIA SELECTIONS INTO DISPLAY SPECIFICATION Final Report, Apr. 1989 - Jan. 1990
Richard D. Gilson and Harley R. Myler Mar. 1991 74 p
(Contract N61339-89-C-0042)
(AD-A235596; ARI-RN-91-36) Avail: NTIS HC/MF A04 CSCL 12/6

This research examined relationships between characteristics of visual stimuli and learning as a first step in developing decision support systems to help estimate visual fidelity requirements for device based training. On the basis of reviews of psychophysical and other literature, it was concluded that little is known about the relationships between characteristics of visual stimuli and learning. An experimental decision support system was nevertheless developed, with critical gaps in essential data as noted. Information herein may be helpful in estimating visual display parameters. Examining the quality of the estimates will require validation research that, because of the time and cost constraints in training device development, is unlikely to be feasible. GRA

N91-27759# Naval Research Lab., Washington, DC.
USER'S GUIDE FOR SAMUEL, VERSION 1.3 Memorandum Report
John J. Grefenstette and Helen G. Cobb 6 May 1991 95 p
(AD-A235611; NRL-MR-6820) Avail: NTIS HC/MF A05 CSCL 12/5

The strategy acquisition method using empirical learning (SAMUEL) is a machine learning system designed to actively explore alternative behavior in a simulated environment, and to construct high performance rules from this experience. The learning method relies on the notion of competition and employs genetic algorithms to search the space of decision policies. The rule language in SAMUEL also makes it easier to incorporate existing knowledge, whether acquired from experts or by symbolic learning programs. The system includes a competition based production system interpreter, incremental strength updating procedures to measure the utility of rules, and genetic algorithms to modify strategies based on past performance. The current version includes a more convenient language for the expression of tactical control rules, better interfaces, and a number of new heuristics for rule modification. We have experimented with SAMUEL on a task involving learning control rules that enable a simulated robotic aircraft to evade an approaching missile. The SAMUEL has been able to learn high performance strategies for this task. This manual should help the user to experiment with SAMUEL on other problems. GRA

N91-27760# Human Engineering Labs., Aberdeen Proving Ground, MD.
THE EFFECTS OF DISPLAY FAILURES, POLARITY, AND CLUTTER ON VISUAL SEARCH FOR SYMBOLS ON CARTOGRAPHIC IMAGES Final Report
Craig J. Dye and Harry L. Synder Apr. 1991 49 p
(DA Proj. 1L1-62716-AH-70)
(AD-A235703; HEL-TM-9-91) Avail: NTIS HC/MF A03 CSCL 12/6

Little research has been conducted about human performance in symbol search of cartographic images on matrix-addressable displays. Alphanumeric studies have researched failures and polarity on such displays but not using cartographic images. Two studies were conducted which required subjects to search for symbols on cartographic images under various conditions of failure, polarity, and background clutter. Response time and accuracy were measured. Generally, high clutter impeded performance more than low clutter, and negative contrast produced slightly better performance than positive contrast. Horizontal line failures affected search ability more than vertical line or cell failures did, particularly when the failures were in the on mode rather than the off mode. Further, it was discovered that while previous alphanumeric studies found effects at 3 percent failures or greater, effects were observed for the present studies at 2 percent or greater, apparently because of the presence of map information on the display. Recommendations for cartographic display design and future research are discussed. GRA

N91-27761# Georgia Inst. of Tech., Atlanta. School of Psychology.
AUTOMATIC INFORMATION PROCESSING AND HIGH-PERFORMANCE SKILLS: PRINCIPLES OF CONSISTENCY, PART-TASK TRAINING, CONTEXT, RETENTION, AND COMPLEX TASK PERFORMANCE Interim Report, Nov. 1989 - Dec. 1990
Arthur D. Fisk, Wendy A. Rogers, Mark D. Lee, Kevin A. Hodge, and Christopher J. Whaley Apr. 1991 289 p
(Contract F33615-88-C-0015)
(AD-A235944; AFHRL-TR-90-84) Avail: NTIS HC/MF A13 CSCL 05/8

Six series of experiments (11 individual experiments) were conducted to further extend automatic/controlled processing research to command and control mission-specific training. The issues examined in these experiments were related to retention of task-component skills; amount of practice; component training for memory-search-dependent tasks; and effects of degree of consistency, context, and task performance dependent on interactions of memory scanning, visual search, rule-based processing and acquisition of procedural knowledge. A final section of the document outlines how the present data provide processing principles which augment previous human performance guidelines that have been shown to be important for high-performance-skills training. GRA

N91-27762# Human Engineering Labs., Aberdeen Proving Ground, MD.
THE EFFECTS OF LINE AND CELL FAILURES ON READING AND SEARCH PERFORMANCE USING MATRIX-ADDRESSABLE DISPLAYS Final Report
Charles J. Lloyd, Jennie J. Decker, and Harry L. Snyder Apr. 1991 56 p
(DA Proj. 1L1-62716-AH-70)
(AD-A235947; HEL-TM-7-91) Avail: NTIS HC/MF A04 CSCL 12/6

Reading and visual search speed and accuracy were used to evaluate the effects of simulated line and cell failures on a visual display. Five experimental variables (failure type cell, vertical line and horizontal line), percent failure 0, 4, 8, or 12 percent cells failed, display polarity light characters on dark background or dark characters on light background, mode of failure failures match the

symbols or failures match the background, and matrix size 7 x 9, 9 x 11, or 11 x 15 dots) significantly affected performance of both the reading and search tasks. Additionally, many of the interactions among these variables were significant. The experimental results indicate that as the percentage of failures increased, performance systematically decreased. For failure levels of less than 4 percent, little effect on performance was found. Performance increased as the size of characters increased. A 30 percent improvement in search time and a 7 percent improvement in reading time was obtained by using dot-matrix sizes larger than 7 x 9 pixels. In general, dark symbols presented on a light background (negative contrast) were read and searched for more quickly than light symbols presented on a dark background (positive contrast). GRA

N91-27763*# Old Dominion Univ., Norfolk, VA. Dept. of Psychology.
OPERATOR STRATEGIES UNDER VARYING CONDITIONS OF WORKLOAD
Ruth J. Arnegard Washington Jul. 1991 225 p
(Grant NGT-504-05)
(NASA-CR-4385; NAS 1.26:4385) Avail: NTIS HC/MF A10 CSCL 05H

An attempt was made to operationally define and measure strategic behavior in a complex multiple task environment. The Multi-Attribute Task battery was developed to simulate various aspects of flight and consisted of an auditory communication task, monitoring tasks, a tracking tasks, a resource management task which allowed a wide range of responding patterns, and a scheduling window which allowed operators to predict changes in workload. This battery was validated for its sensitivity to strategic behavior, and baseline measures for each individual task were collected. Twenty-four undergraduate and graduate students then performed the battery for four 64 minute sessions which took place over a period of 2 days. Each subject performed the task battery under four levels of workload, which were presented for equal lengths of time during all four sessions. Results indicated that in general, performance improves as a function of experience with the battery, but that performance decreased as workload level increased. The data also showed that subjects developed strategies for responding to the resource management task which allowed them to manage the high workload levels more efficiently. This particular strategy developed over time but was also associated with errors of complacency. These results are presented along with implications for the aviation field and areas of future research. Author

N91-27764*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, CA.
OBSERVER PROPERTIES FOR UNDERSTANDING DYNAMICAL DISPLAYS: CAPACITIES, LIMITATIONS, AND DEFAULTS
Dennis R. Proffitt (Virginia Univ., Charlottesville.) and Mary K. Kaiser Feb. 1991 15 p
(NASA-TM-102812; A-90136; NAS 1.15:102812) Avail: NTIS HC/MF A03 CSCL 05I

People's ability to extract relevant information while viewing ongoing events is discussed in terms of human capabilities, limitations, and defaults. A taxonomy of event complexity is developed which predicts which dynamical events people can and cannot construe. This taxonomy is related to the distinction drawn in classical mechanics between particle and extended body motions. People's commonsense understandings of simple mechanical systems are impacted little by formal training, but rather reflect heuristical simplifications that focus on a single dimension of perceived dynamical relevance. Author

N91-27751# Joint Publications Research Service, Arlington, VA.
BIOLOGICAL EXPERIMENTS ON KOSMOS-1887 BIOSATELLITE
A. M. Alpatov, Ye. A. Ilin, V. V. Antipov, and M. G. Tairbekov *In its* JPRS Report: Science and Technology. USSR: Life Sciences 9 Jan. 1991 p 68-72 Transl. into ENGLISH from Kosmicheskaya Biologiya i Aviakosmicheskaya Meditsina, Moscow (USSR), v. 23, no. 5, Sep.-Oct. 1989 p 26-32 (For primary document see N91-27744 19-52)
Avail: NTIS HC/MF A05

54 MAN/SYSTEM TECHNOLOGY AND LIFE SUPPORT

Includes human engineering; biotechnology; and space suits and protective clothing.

For related information see also *16 Space Transportation.*

N91-27765*# Alabama Univ., Huntsville.
ECLSS ADVANCED AUTOMATION PRELIMINARY REQUIREMENTS Final Report
Brenda D. Lukefahr, Daniel M. Rochowiak, Brian L. Benson, John S. Rogers, and James W. McKee Nov. 1989 168 p
(Contract NAS8-36955)
(NASA-CR-186115; NAS 1.26:186115; UAH-RR-823) Copyright Avail: NTIS HC/MF A08 CSCL 06K

A description of the total Environmental Control and Life Support System (ECLSS) is presented. The description of the hardware is given in a top down format, the lowest level of which is a functional description of each candidate implementation. For each candidate implementation, both its advantages and disadvantages are presented. From this knowledge, it was suggested where expert systems could be used in the diagnosis and control of specific portions of the ECLSS. A process to determine if expert systems are applicable and how to select the expert system is also presented. The consideration of possible problems or inconsistencies in the knowledge or workings in the subsystems is described. Author

N91-27766*# Alabama Univ., Huntsville.
A DIAGNOSTIC PROTOTYPE OF THE POTABLE WATER SUBSYSTEM OF THE SPACE STATION FREEDOM ECLSS Final Report
Brenda D. Lukefahr, Daniel M. Rochowiak, Brian L. Benson, John S. Rogers, and James W. McKee Nov. 1989 49 p
(Contract NAS8-36955)
(NASA-CR-186111; NAS 1.26:186111; UAH-RR-824) Copyright Avail: NTIS HC/MF A03 CSCL 06K

In analyzing the baseline Environmental Control and Life Support System (ECLSS) command and control architecture, various processes are found which would be enhanced by the use of knowledge based system methods of implementation. The most suitable process for prototyping using rule based methods are documented, while domain knowledge resources and other practical considerations are examined. Requirements for a prototype rule based software system are documented. These requirements reflect Space Station Freedom ECLSS software and hardware development efforts, and knowledge based system requirements. A quick prototype knowledge based system environment is researched and developed. Author

N91-27767# Technical Research Centre of Finland, Espoo. LVI-Tekniikan Laboratorio.
THE EFFECTS OF AIR TEMPERATURE AND OTHER INDOOR CLIMATE FACTORS ON WORK PRODUCTIVITY
E. Tammela (Tyoeterveyslaitos, Helsinki, Finland) 1990 54 p In FINNISH; ENGLISH summary
(DE91-771954; VTT/LVIS2000-2) Avail: NTIS HC/MF A04

The aim was to review the effects of air temperature and other indoor climate factors on work productivity and to find out whether a wider experimental study is necessary in Finland. The effects of hot conditions on human performance have been widely investigated in laboratories. Generally the aim has been to find the exposure limits in which people can work without harm to their health and to determine the mechanism on which the performance loss in based. Accerding to these studies the performance in mentally demanding and also in very simple tasks

deteriorates at a temperature above 33 C. The results are partly contradictory, which is due to numerous confusing factors related to the studies and to many other factors affecting performance, e.g., thermal characteristics, time of exposure, type of task, level of arousal, skill and motivation of the worker. Most of the studies near the range of comfort have dealt with the effects of air temperature on learning. These studies have been conducted in schools, in observation classrooms and in laboratories. Performance began to deteriorate at an air temperature of 27 C or more. There are only a few studies concerning the effects of thermal conditions on productivity in office work. In some studies mild thermal stress has resulted in a lowered performance and in others no differences have been found. Well motivated persons may be quite unaffected by mild thermal stress. Mild heat stress increases the degree of experienced symptoms and fatigue and decreases work satisfaction. There is no evidence suggesting that a temperature other than that found comfortable by the majority will produce more work output. DOE

N91-27768# Joint Publications Research Service, Arlington, VA.
JPRS REPORT: SCIENCE AND TECHNOLOGY. USSR: LIFE SCIENCES
20 Mar. 1991 52 p Transl. into ENGLISH from various Russian articles
(JPRS-ULS-91-006) Avail: NTIS HC/MF A04

Abstracts of Soviet research projects in the area of the life sciences is presented. The following topics are covered: biochemistry, biotechnology, molecular biology, physiology, public health, and virology. One particular abstract is presented in the field of aerospace medicine on the subject of habitability and biological life support systems. For individual title, see N91-27769.

N91-27769# Joint Publications Research Service, Arlington, VA.
HABITABILITY AND BIOLOGICAL LIFE SUPPORT SYSTEMS
O. G. Gazenko, A. I. Grigoryev, G. I. Meleshko, and Ye. Ya. Shepelev *In its* JPRS Report: Science and Technology. USSR: Life Sciences 20 Mar. 1991 p 1-6 Transl. into ENGLISH from Kosmicheskaya Biologiya i Aviakosmicheskaya Meditsina, Moscow (USSR), v. 24, no. 3, May-Jun. 1990 p 12-17 (For primary document see N91-27768 19-54)
Avail: NTIS HC/MF A04

Problems about man's attitude toward biological life support systems (BLSS's) are discussed. Man's understanding of the purpose and role of BLSS's in the future of cosmonautics depends on an understanding of the problem of habitability. If the concept of habitability is based on the satisfaction of a familiar list of individual physiological and hygiene requirements, then the task of life support systems (LSS's) can be understood purely from the viewpoint of a consumer: as one of ensuring the parameters required of the environment and the amount of its required components (oxygen, water, and food). If the problem is based on the ecological concept of the habitat in the broad sense, then ecological, not consumer, requirements must be imposed on the LSS as a system for total development of a biologically complete habitat adequate for man's biological needs and meeting, in principle, the basic criteria of the natural environment on Earth. This is the reason for the different approaches to evaluating the prospects of BLSS's used by designers on the one hand and doctors studying human living conditions in space facilities on the other. The importance of defining relations between the concept of habitability and the role of the means that ensure it are discussed. Author

N91-27770# Navy Clothing and Textile Research Facility, Natick, MA.
PHYSIOLOGICAL ACCEPTANCE CRITERIA FOR COLD WEATHER CLOTHING Final Report, Oct. 1988 - Dec. 1989
Nancy A. Pimental Apr. 1991 22 p
(Navy Proj. TM33I311)
(AD-A235670; NCTRF-185) Avail: NTIS HC/MF A03 CSCL 15/5

The purpose of the present investigation was to develop physiological limit criteria for cold weather clothing items which meet the limits for protection against development of a cold injury, and which are also associated with an increased level of subjective comfort and acceptance. The literature on physiological responses to cold was reviewed. The relationships of responses such as body core temperature, skin temperatures and shivering to subjective feelings of thermal comfort and temperature sensation were examined. Under many conditions that Navy cold weather clothing items are worn, it is not practical to expect that the optimal level of thermal comfort can be obtained. Allowing for a moderate level of cold sensation and thermal discomfort, the following physiological criteria for acceptance of cold weather clothing items were developed: (1) a mean weighted skin temperature is greater than or equal to 28 C (82 F), (2) local skin temperature at any site is greater than or equal to 18 C (64 F), (3) a metabolic rate due to shivering is less than twice the normal resting rate (metabolic rate is greater than or equal to approximately 180 kcal/hr). All three criteria must be met. Application of these criteria will enable better evaluation of and comparison to cold weather clothing items. GRA

N91-27771# Naval Ocean Systems Center, San Diego, CA.
AEGIS STATUS-DISPLAY FORMATS: TRADEOFF STUDIES
James W. Broyle May 1991 5 p
(AD-A236969) Avail: NTIS HC/MF A01 CSCL 12/6

An experiment was designed to collect human performance data on current and experimental status display formats for a Navy Workstation (i.e., Aegis Combat System). Current information display methods do not take advantage of human processing capabilities of using graphics (e.g., icons, bar-graphs, or color) and integrating the information on the display to fit the operator's task. The focus of the experiment was to provide human performance data to support the trade-off analyses of display formats and to investigate the feasibility of applying these techniques to future control/display upgrades. Eleven subjects (6 Navy personnel with Aegis combat system experience and 5 Navy researchers) viewed different display formats of the Guided Missile Launcher System Character Read-out (CRO). The subjects answered 16 questions about system status on each of the display layouts. The experiment compared operator accuracy and response times when reading information across the displays. We found that operator performance may differ as a function of layout of information on a CRO and the cognitive processes required to execute the task. Other design improvements for future studies will be discussed. GRA

N91-27772# Naval Ocean Systems Center, San Diego, CA.
SOME PRAGMATIC ISSUES OF MEASUREMENT
T. P. Enderwick May 1991 8 p
(AD-A236992) Avail: NTIS HC/MF A02 CSCL 14/2

Measurement is the cornerstone of Human Factors (HF) research and testing. To facilitate discussions HF testing will be treated as a special case of HF research in that testing uses many of the same methods and measurements. HF research is applied research which means the results are always expected to have a use. This does not mean that the results are necessarily unrelated to theory evaluation. This simply means that the sponsor and user have the right to know what the utility and limitations of the results are in relation to the specific problems or questions posed prior to the research. This, in turn, determines the selection and/or development of measures to be used in research and testing. This gives rise to a number of pragmatic issues for research in general and measurement in particular. The topics in this paper are somewhat diversified. First, some of the potential users will be identified along with their needs in respect to HF research and testing. This will be followed by a discussion of some pragmatic issues and end with a suggested approach for evaluating crew's contribution to system performance. GRA

N91-28068*# Texas Southern Univ., Houston. Dept. of Home Economics.
INTERNATIONAL FOOD PATTERNS FOR SPACE FOOD
Selina Ahmed, Amanda Cox, and Pauline V. Cornish *In* Alabama

A & M Univ., NASA-HBCU Space Science and Engineering Research Forum Proceedings 1989 p 26-32 (For primary document see N91-28063 19-99)
Avail: NTIS HC/MF A23 CSCL 06H

N91-28109*# National Aeronautics and Space Administration. Langley Research Center, Hampton, VA.
END-EFFECTOR-JOINT CONJUGATES FOR ROBOTIC ASSEMBLY OF LARGE TRUSS STRUCTURES IN SPACE: A SECOND GENERATION
William V. Brewer *In* Alabama A & M Univ., NASA-HBCU Space Science and Engineering Research Forum Proceedings 1989 p 336-34 Prepared in cooperation with Jacksonville State Univ., AL (For primary document see N91-28063 19-99)
Avail: NTIS HC/MF A23 CSCL 06K

N91-28110*# Prairie View Agricultural and Mechanical Coll., TX. Dept. of Electrical Engineering.
MARS SURFACE BASED FACTORY. PHASE 2, TASK 1C: COMPUTER CONTROL OF A WATER TREATMENT SYSTEM TO SUPPORT A SPACE COLONY ON MARS
John Fuller, Warsame Ali, and Danette Willis *In* Alabama A & M Univ., NASA-HBCU Space Science and Engineering Research Forum Proceedings 1989 p 343-34 (For primary document see N91-28063 19-99)
Avail: NTIS HC/MF A23 CSCL 06K

55 SPACE BIOLOGY

Includes exobiology; planetary biology; and extraterrestrial life.

No abstracts in this category.

59 MATHEMATICAL AND COMPUTER SCIENCES (GENERAL)

N91-27773*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, CA.
ADVANCING AUTOMATION AND ROBOTICS TECHNOLOGY FOR THE SPACE STATION FREEDOM AND FOR THE U.S. ECONOMY. SUBMITTED TO THE CONGRESS OF THE U.S. MAY 1991 Progress Report No. 12, 23 Aug. 1990 - 14 Feb. 1991
Henry Lum, Jr. May 1991 44 p
(NASA-TM-103851; A-91105; NAS 1.15:103851) Avail: NTIS HC/MF A03 CSCL 22B

In April 1985, as required by Public Law 98-371, the NASA Advanced Technology Advisory Committee (ATAC) reported to Congress the results of its studies on advanced automation and robotics technology for use on Space Station Freedom. This material was documented in the initial report (NASA Technical Memorandum 87566). A further requirement of the law was that ATAC follow NASA's progress in this area and report to Congress semiannually. The report describes the progress made by Levels 1, 2 and 3 of the Office Space Station in developing and applying advanced automation and robotics technology. Emphasis has been placed upon the Space Station Freedom Program responses to specific recommendations made in ATAC Progress Report 11, the status of the Flight Telerobotic Servicer, and the status of the Advanced Development Program. In addition, an assessment is provided of the automation and robotics status of the Canadian Space Station Program. Author

60 COMPUTER OPERATIONS AND HARDWARE

Includes hardware for computer graphics, firmware, and data processing.

For components see *33 Electronics and Electrical Engineering.*

N91-27774# Sandia National Labs., Albuquerque, NM.
A 1K SHADOW RAM FOR CIRCUMVENTION APPLICATIONS
J. R. Murray 1991 5 p Presented at the IEEE Annual International Nuclear and Space Radiation Effects Conference, San Diego, 15-19 Jul. 1991
(Contract DE-AC04-76DP-00789)
(DE91-007892; SAND-91-0263C; CONF-910751-1) Avail: NTIS HC/MF A01

A 1K bit Shadow RAM has been developed for storage of critical data in a high transient radiation environment. The circuit includes a 1K bit (128 x 8) static RAM with two non-volatile (NV) shadows. The NV shadows are used to back-up the data in the static RAM allowing the circuit to be powered down during transient radiation without losing critical data. This paper will describe the circuit's operation and characterization results. DOE

N91-27775*# NASA VLSI Hardware Acceleration Center for Space Research, Idaho Univ., Moscow.
A VERY HIGH SPEED LOSSLESS COMPRESSION/DECOMPRESSION CHIP SET
Jack Venbrux, Norley Liu, Kathy Liu, Peter Vincent, and Randy Merrell 15 Jul. 1991 17 p Sponsored inpart by NASA. Goddard Space Flight Center
(NASA-CR-188655; NAS 1.26:188655; JPL-Publ-91-13) Avail: NTIS HC/MF A03 CSCL 09B

A chip is described that will perform lossless compression and decompression using the Rice Algorithm. The chip set is designed to compress and decompress source data in real time for many applications. The encoder is designed to code at 20 M samples/second at MIL specifications. That corresponds to 280 Mbits/second at maximum quantization or approximately 500 Mbits/second under nominal conditions. The decoder is designed to decode at 10 M samples/second at industrial specifications. A wide range of quantization levels is allowed (4...14 bits) and both nearest neighbor prediction and external prediction are supported. When the pre and post processors are bypassed, the chip set performs high speed entropy coding and decoding. This frees the chip set from being tied to one modeling technique or specific application. Both the encoder and decoder are being fabricated in a 1.0 micron CMOS process that has been tested to survive 1 megarad of total radiation dosage. The CMOS chips are small, only 5 mm on a side, and both are estimated to consume less than 1/4 of a Watt of power while operating at maximum frequency. Author

N91-27776# Joint Publications Research Service, Arlington, VA.
JPRS REPORT: SCIENCE AND TECHNOLOGY. USSR: COMPUTERS
30 Apr. 1991 46 p Transl. into ENGLISH from various Russian articles
(JPRS-UCC-91-001) Avail: NTIS HC/MF A03

Topics addressed include: general computer information; software engineering; applications; computer networks; and the theory of computation. B.G.

N91-27777# Naval Postgraduate School, Monterey, CA.
AN AERONAUTICAL ENGINEERING USER'S MANUAL TO THE HP-28S HANDHELD CALCULATOR M.S. Thesis
Harry F. Molyneux Mar. 1991 68 p
(AD-A236618) Avail: NTIS HC/MF A04 CSCL 12/6

Handheld calculators are now powerful enough to have become indispensible tools for the engineer and scientist. With enhanced equation solving capability and extensive user memory, the HP-28S introduces exciting new possibilities. The entire set of tables for one-dimensional gas dynamics can be accessed with unequalled

accuracy and speed. But this enhanced power cannot be properly tapped without a pre-planned user directory organization which takes advantage of the HP-28S internal structure. Experience has shown that many students buy expensive programmable calculators but underuse them, finding their powerfulness baffling and frustrating. They employ the same computational techniques with sophisticated $200 continuous memory programmable machines as could be accomplished with a simple $20 scientific calculator. This manual contains a compendium of useful formulae, programming, and computational techniques for the popular HP-28S Pocket Calculator. In addition to helpful instructions on units conversion, directory organization, and problem solving methodology which will benefit any HP-28S user, the Aeronautical Engineering student will find sections on Thermodynamics, Aerodynamics, and Controls which will prove useful in those fields of study. GRA

N91-27778# Naval Postgraduate School, Monterey, CA.
THE PORTING OF MAINFRAME-DEPENDENT ANTENNA MODELING PROGRAM (NEC-3) TO A 32-BIT PERSONAL COMPUTER M.S. Thesis
James J. Wright Jun. 1990 98 p
(AD-A236711) Avail: NTIS HC/MF A05 CSCL 12/5

The feasibility is demonstrated of porting a large mainframe-dependent scientific FORTRAN program, specifically the Numerical Electromagnetics Code (NEC-3) to a 32-bit personal computer. Two systems, an AST Premium 386/33 with both Intel 80387 and Weitek w3167 math co-processors and a Definicon DSI-780 using a Motorola 68020 CPU and 68881 math co-processor, were used with several 32-bit FORTRAN 77 compilers. Results show that when Nec-3 was promoted to full double precision, complete accuracy was maintained while suffering only a 12 pct. increase in execution time over single precision. Testing also revealed that the double precision Weitek version is 30 pct. faster than the 80387 version. Some small inaccuracies remain; however, the same results were obtained by both the Naval Postgraduate School mainframe's new IBM VS2 FORTRAN 77 compiler and the personal computer FORTRAN 77 compilers. This indicates that the bug is in the NEC-3 code, vice being hardware or FORTRAN 77 compiler problem. GRA

N91-27779# National Center for Atmospheric Research, Boulder, CO.
WORKSHOP ON THE ONLINE DOCUMENTATION IN THE SUPERCOMPUTING ENVIRONMENT, WORKING PAPER CONFERENCE
G. Caldwell, M. Cohen, J. Rew, and A. Solem Dec. 1990 175 p Workshop held in Colorado Springs, CO, 3-6 Apr. 1990 Also published at LANL, NM, Rept. No. LA-11990-C Prepared in cooperation with Los Alamos National Lab., NM Sponsored in part by NSF
(Contract W-7405-eng-36)
(PB91-164772; NCAR/TN-353+PROC; LA-11990-C) Avail: NTIS HC/MF A08 CSCL 09B

Many people are interested in online user documentation for supercomputers and the continuing problems that plague us: problems of delivering online information in a heterogeneous computing environment that includes supercomputers and workstations, and lack of vendor solutions that work in diverse computing environments for diverse types of documentation. As a group representing twelve diverse supercomputing centers, participants in the workshop saw a need for a common online documentation system that could serve a heterogeneous distributed computing environment. They also desired the efficiency to be gained of sharing documentation in machine-readable form among hardware and software vendors as well as between supercomputing centers. They did not see any currently existing software products meeting all of these needs and thus established a forum to advocate the development or evolution of a suitable online documentation system. The Workshop was effective in bringing together people from the supercomputing sites and developing new insights into the problems and possible solutions. A steering committee composed of a representative from each supercomputing site was formed to continue the efforts of advocating the development or evolution of a suitable online documentation system in the supercomputing environment and to enhance opportunities for collaboration among the many interested sites. GRA

61 COMPUTER PROGRAMMING AND SOFTWARE

Includes computer programs, routines, alogorithms, and specific applications, e.g., CAD/CAM.

N91-27780# Ada Joint Program Office, Washington, DC.
PROCEEDINGS OF THE 5TH ANNUAL Ada SOFTWARE ENGINEERING EDUCATION AND TRAINING (ASEET) SYMPOSIUM
Aug. 1990 133 p Symposium held 14-16 Aug. 1990
(AD-A234029) Avail: NTIS HC/MF A07 CSCL 12/5

Papers and panel position papers are presented that would have been presented or distributed at the Symposium which was canceled. Panel discussions on (1) Curriculum Trends in Software Engineering; (2) Lessons Learned in Software Engineering taught with Ada; and (3) The Future of Ada. Papers presented such as: Implementation of Artificial Systems in Ada; A Design Methodology for Object Based Languages; Program Development and Ada; STANFINS Redesign Subsystem II: Developing a Large MIS Application Using Ada; The Place of Ada in an Undergraduate Software Engineering Curriculum; and Using Short Laboratory Exercises to Develop Ada Awareness. GRA

N91-27781# Argonne National Lab., IL.
THE LANCZOS ALGORITHM FOR THE GENERALIZED SYMMETRIC EIGENPROBLEM ON SHARED-MEMORY ARCHITECTURES
M. T. Jones and M. L. Patrick Sep. 1990 12 p Presented at the 13th IMACS World Congress on Computation and Applied Mathematics, Dublin (Ireland), 22-26 Jul. 1991
(Contract W-31-109-eng-38)
(DE91-006044; CONF-910771-1) Avail: NTIS HC/MF A03

The generalized eigenvalue problem, Kx = (lambda)Mx, is of significant practical importance, for example, in structural engineering where it arises as the vibration and buckling problems. The paper describes the implementation of a solver based on the Lanczos algorithm, LANZ, on two shared-memory architectures, the CRAY Y-MP and Encore Multimax. Issues arising from implementing linear algebra operations on a multivector processor are examined. Portability between a multivector processor and a simple multiprocessor is discussed. A model is developed and used to predict the performance of LANZ on shared-memory architectures. Performance results from some practical problems are given and analyzed. DOE

N91-27782# Los Alamos National Lab., NM.
INFORMATION THEORETIC DERIVATION OF NETWORK ARCHITECTURE AND LEARNING ALGORITHMS
R. D. Jones, C. W. Barnes, Y. C. Lee, and W. C. Mead 1991 7 p Presented at the 1991 International Joint Conference on Neural Networks (IJCNN), Seattle, 8-12 Jul. 1991
(Contract W-7405-eng-36)
(DE91-007552; LA-UR-91-325; CONF-910779-3) Avail: NTIS HC/MF A02

Using variational techniques, a feedforward network architecture was derived that minimizes a least squares cost function with the soft constraint that the mutual information between input and output be maximized. This permits optimum generalization for a given accuracy. A set of learning algorithms are also obtained. The network and learning algorithms are tested on a set of test problems which emphasize time series prediction. DOE

N91-27783# Los Alamos National Lab., NM.
THE PERFORAMANCE OF GENETIC ALGORITHMS ON WALSH POLYNOMIALS: SOME ANOMALOUS RESULTS AND THEIR EXPLANATION
S. Forrest and M. Mitchell (Michigan Univ., Ann Arbor.) 1991 12 p Presented at the 4th International Conference on Genetic Algorithms, San Diego, Jul. 1991
(Contract W-7405-eng-36)
(DE91-008603; LA-UR-91-657; CONF-910784-1) Avail: NTIS HC/MF A03

A number of seemingly anomalous results reported concerning the performance of the genetic algorithm (GA) on a subclass of Walsh polynomials is discussed. It was found that the GA optimized these functions poorly and that a partitioning of a single large population into a number of smaller independent populations seemed to improve performance. We reexamine these results experimentally and theoretically, and propose and evaluate some explanations. In addition, we examine the question of what are reasonable and appropriate ways to measure the performance of genetic algorithms. DOE

N91-27784# Lawrence Livermore National Lab., CA.
LINEAR RADIOSITY APPROXIMATION USING VERTEX RADIOSITIES
N. Max (California Univ., Davis.) and M. Allison Dec. 1990 15 p Presented at the SIGGRAPH 1991, Las Vegas, 28 Jul. - 2 Aug. 1991
(Contract W-7405-eng-48)
(DE91-009754; UCRL-JC-105783; CONF-910792-1) Avail: NTIS HC/MF A03

Using radiosities computed at vertices, the radiosity across a triangle can be approximated by linear interpolation. We develop vertex-to-vertex form factors based on this linear radiosity approximation, and show how they can be computed efficiently using modern hardware-accelerated shading and z-buffer technology. DOE

N91-27785*# Cornell Univ., Ithaca, NY. Dept. of Computer Science.
DERIVATION OF SEQUENTIAL, REAL-TIME, PROCESS-CONTROL PROGRAMS
Keith Marzullo, Fred B. Schneider, and Navin Budhiraja Jul. 1991 15 p
(Contracts NAG2-593; N00140-87-C-8904; N00014-86-K-0092; NSF CCR-90-03440)
(NASA-CR-185433; NAS 1.26:185433) Avail: NTIS HC/MF A03 CSCL 09B

The use of weakest-precondition predicate transformers in the derivation of sequential, process-control software is discussed. Only one extension to Dijkstra's calculus for deriving ordinary sequential programs was found to be necessary: function-valued auxiliary variables. These auxiliary variables are needed for reasoning about states of a physical process that exists during program transitions. Author

N91-27786*# Computational Logic, Inc., Austin, TX.
REPORT ON THE FORMAL SPECIFICATION AND PARTIAL VERIFICATION OF THE VIPER MICROPROCESSOR Technical Report No. 46
Bishop Brock and Warren A. Hunt, Jr. Jul. 1991 32 p
(ARPA Order 58-4155; NASA Order L-39627C)
(NASA-CR-187540; NAS 1.26:187540) Avail: NTIS HC/MF A03 CSCL 09B

The formal specification and partial verification of the VIPER microprocessor is reviewed. The VIPER microprocessor was designed by RSRE, Malvern, England, for safety critical computing applications (e.g., aircraft, reactor control, medical instruments, armaments). The VIPER was carefully specified and partially verified in an attempt to provide a microprocessor with completely predictable operating characteristics. The specification of VIPER is divided into several levels of abstraction, from a gate-level description up to an instruction execution model. Although the consistency between certain levels was demonstrated with mechanically-assisted mathematical proof, the formal verification of VIPER was never completed. Author

N91-27787# Syracuse Univ., NY.
SOFTWARE ENGINEERING FOR FAULT TOLERANT SYSTEMS Final Technical Report, Jan. 1989 - Aug. 1990
Amrit L. Goel and Nashat Mansour Mar. 1991 125 p
(Contract F30602-88-D-0027)
(AD-A235459; RL-TR-91-15) Avail: NTIS HC/MF A06 CSCL 12/5

The objectives of this study are to: (1) assess the current state of the art of fault tolerant software schemes; (2) evaluate the status of various software engineering issues in this context; (3) identify critical gaps in the currently available technology; and (5) provide recommendations for research and development efforts to enhance the technological base of fault tolerant software engineering. Towards these objectives, we have discussed several software fault tolerance schemes, studied the available experimental and analytical evidence about their usefulness, and assessed the current status of fault tolerant software engineering for sequential and parallel computers. Based on the studies reported here, we feel that the current state-of-the-art of fault tolerant software is mature enough to tolerate design faults in specific circumstances with appropriate provisions of redundancy and allied supporting mechanisms. However, no known fault tolerance technique can guarantee failure-free system operation. Furthermore, it is questionable whether the current approaches are cost-effective in achieving the desired gain in operational software reliability. We feel that what is needed is a systematic, cost effective approach to software development which explicitly addresses the fault tolerance issues throughout the development life-cycle. GRA

N91-27788# Carnegie-Mellon Univ., Pittsburgh, PA. Software Engineering Inst.
TRANSACTION-ORIENTED CONFIGURATION MANAGEMENT: A CASE STUDY
Peter H. Feiler and Grace F. Downey Nov. 1990 53 p
(AD-A235510; CMU/SEI-90-TR-23; ESD-90-TR-224) Avail: NTIS HC/MF A04 CSCL 12/5

Software configuration management (SCM) is a key element of the software development process. A number of new configuration management techniques in commercial SCM tools and environments with SCM capabilities have been observed. This report illustrates some of the advances in SCM concepts by example of a particular commercial system, the Sun Network Software Environment (NSE). NSE embodies a transaction model of configuration management. In order to demonstrate the capabilities and limitations of the transaction model, NSE is applied to three problem areas for configurations management: adaption for parallel development and team support, development and maintenance in software families and development in a distributed and heterogeneous network. GRA

N91-27789# Dayton Univ., OH.
AUTOMATIC INFORMATION PROCESSING AND HIGH-PERFORMANCE SKILLS: APPLICATIONS TO TRAINING, TRANSFER, AND RETENTION Interim Report, Nov. 1989 - Dec. 1990
F. T. Eggemeier, Samuel M. Bower, Andrea B. Granitz, Timothy E. Rogus, and Jennifer A. Mitchell Apr. 1991 201 p
(Contract F33615-88-C-0015)
(AD-A235537; AFHRL-TR-90-83) Avail: NTIS HC/MF A10 CSCL 05/6

A laboratory research effort which investigated automatic information processing theory and high-performance skills training is documented. Training research issues pertaining to skill acquisition, transfer of training, or retention were investigated with analogs of Command and Control (C2) operator tasks in ten experiments. The results of the research indicate that elements of automatic processing theory are applicable to the training of C2 task analogs, suggest some limits on the transfer that can be

expected under both aided and non-aided training conditions, and indicate that automatic processes associated with spatial pattern information show no significant decrement over 30-day retention intervals. GRA

N91-27790# Cornell Univ., Ithaca, NY. Dept. of Computer Science.
MASKING FAILURES OF MULTIDIMENSIONAL SENSORS
Paul Chew and Keith Marzullo Feb. 1991 18 p
(Contracts N00014-88-K-0591; N00014-89-J-1946; N00140-87-C-8904; NSF IRI-90-06137)
(AD-A235580; CU-CSD-TR-91-1190) Avail: NTIS HC/MF A03 CSCL 12/5

When a computer monitors a physical process, the computer uses sensors to determine the values of the physical variables that represent the state of the process. A sensor can sometimes fail, however, and in the worst case report a value completely unrelated to the true physical value. The work described in this paper is motivated by a methodology for transforming a process control program that cannot tolerate sensor failure into one that can. In this methodology, a reliable abstract sensor is created by combining information from several real sensors that measure the same physical value. To be useful, an abstract sensor must deliver reasonably accurate information at reasonable computational cost. In this paper, we consider sensors that deliver multidimensional values (e.g., location or velocity in 3 dimensions). Geometric techniques are used to derive upper bounds on abstract sensor accuracy and to develop efficient algorithms for implementing abstract sensors. Author (GRA)

N91-27791# RAND Corp., Santa Monica, CA.
SUGGESTED MODIFICATIONS TO OPTICAL SENSOR ALGORITHMS IN JANUS Interim Report
H. H. Bailey, L. G. Mundie, and H. A. Ory Nov. 1990 33 p
(Contracts MDA903-90-C-0004; MDA903-86-C-0059; F49620-86-C-0008)
(AD-A235592; RAND/N-3087-DR-E/A/AF) Avail: NTIS HC/MF A03 CSCL 17/5

Optical sensor algorithms in the JANUS (T) ground combat simulation do not include a repeated detection criterion for target acquisition and weapon firing, nor do they provide for the effects of false detections. As a result, targets detected with very low probability, such as those at ranges near the performance limit of the sensor, will often give rise to acquisition and weapon firing decisions when rare single detections result from coverage by many sensors and time cycles. The detection algorithms are reviewed for optical sensors implemented in JANUS (T), some approximations are identified that can lead to overoptimistic estimates of target acquisition probabilities when the calculated detection probability is small, and suggests an acquisition criterion that alleviates the problem. GRA

N91-27792# Carnegie-Mellon Univ., Pittsburgh, PA. Software Engineering Inst.
TOOL VERSION MANAGEMENT TECHNOLOGY: A CASE STUDY Final Report
Peter H. Feiler and Grace F. Downey Nov. 1990 35 p
(Contract F19628-90-C-0003)
(AD-A235639; CMU/SEI-90-TR-25; ESDXF-TR-90-226ESD)
Avail: NTIS HC/MF A03 CSCL 12/5

This report describes a portion of the problem of maintaining tools for the purpose of software development. It discusses an innovative solution to tool version management available in the commercially available Network Software Environment from Sun Microsystems, Inc. It applies NSE mechanisms to solve three problems that are common to the use and management of tools for software development. The primary focus of this task is on environment support for the management of tool versions and automation of tool version management and selection, and to discuss an innovative solution available in a commercial software development environment. We discuss a problem that any facility providing support for software development faces: the management of software development tools. The problem is broken down into three issues: tool version organization and selection, the stability of selected tool versions and the application context of selected tool versions. GRA

N91-27793# Carnegie-Mellon Univ., Pittsburgh, PA. Software Engineering Inst.
CASE TOOL INTEGRATION AND STANDARDIZATION Final Report
Paul F. Zarrella Dec. 1990 35 p
(Contract F19628-90-C-0003)
(AD-A235640; CMU/SEI-90-TR-14; ESDXF-TR-90-215ESD)
Avail: NTIS HC/MF A03 CSCL 12/5

Computer Aided Software Engineering tool users are faced with the task of coordinating tools and data from a variety of sources spanning the entire software development life cycle. Despite much discussion and increased standardization activity, complete, transparent CASE tool integration is still a long way from realization. There are a number of factors which have complicated the tool integration scenario and a number of actions being taken in an attempt to resolve the problems. The implications of these concerns can be examined from the perspectives of single-vendor, multiple-vendor, operating environment, development process, and end user integration. In addition to specific technical and methodological solutions, standards efforts are viewed as a possible path to tool integration. To date, formal efforts have done little to resolve the integration problems, but defacto standards may well become the cornerstone of future CASE tool evolution. GRA

N91-27794# Carnegie-Mellon Univ., Pittsburgh, PA. Software Engineering Inst.
RATE MONOTONIC ANALYSIS FOR REAL-TIME SYSTEMS Final Report
Lui Sha, Mark H. Klein, and John B. Goodenough Mar. 1991 30 p
(Contract F19628-90-C-0003)
(AD-A235641; CMU/SEI-91-TR-6; ESD-91-TR-6) Avail: NTIS HC/MF A03 CSCL 12/5

The essential goal of the Rate Monotonic Analysis (RMA) for Real-Time Systems Project at the Software Engineering Institute is to catalyze improvement in the practice of real time systems engineering, specifically by increasing the use of rate monotonic analysis and scheduling algorithms. In this report, important decisions in the development of RMA are reviewed. The experience indicates that technology transition considerations should be embedded in the process of technology development from the start, rather than as an afterthought. GRA

N91-27795# Carnegie-Mellon Univ., Pittsburgh, PA. Software Engineering Inst.
USER INTERFACE DEVELOPMENT Final Report
Gary Perlman Nov. 1989 87 p Prepared in cooperation with Ohio State Univ., Columbus
(Contract F19628-90-C-0003)
(AD-A235699; CMU/SEI-CM-17-1-1) Avail: NTIS HC/MF A05 CSCL 09/2

This module covers the issues, information sources, and methods used in the design, implementation, and evaluation of user interfaces, the parts of software systems designed to interact with people. User interface design draws on the experiences of designers, current trends in input/output technology, cognitive psychology, human factors (ergonomics) research, guidelines and standards, and on the feedback from evaluating working systems. User interface implementation applies modern software development techniques to building user interfaces. User interface evaluation can be based on empirical evaluation of working systems or on the predictive evaluation of system design specifications. GRA

N91-27796# Carnegie-Mellon Univ., Pittsburgh, PA. Software Engineering Inst.
UNDERSTANDING PROGRAM DEPENDENCIES Final Report
Norman Wilde Aug. 1990 31 p Prepared in cooperation with

University of West Florida
(Contract F19628-90-C-0003)
(AD-A235700; CMU/SEI-CM-26) Avail: NTIS HC/MF A03
CSCL 12/5

A key to program understanding is unravelling the interrelationships of program components. This module discusses the different methods and tools that aid a programmer in answering the questions: How does this system fit together? and If I change this component, what other components might be affected? Victor Basili has said, most software systems are complex, and modification requires a deep understanding of the functional and non-functional requirements, the mapping of functions to system components, and the interaction of components. This module is about methods and tools for the last of these problems, that is, the understanding of interactions among program components. Program components may be of many types, depending on the development methodology and the programming language used. However, this module will be restricted to those components that are found in codes written in almost all conventional procedural programming languages: data items data types subprograms, and source files. The module will present a classification of some of the main kinds of dependencies between these components, a discussion of the main methods for discovering the dependencies starting from the code, and a description of some of the ways that dependency information can be usefully presented to a programmer. GRA

N91-27797# Carnegie-Mellon Univ., Pittsburgh, PA. Software Engineering Inst.
SOFTWARE DESIGN METHODS FOR REAL-TIME SYSTEMS Final Report
Hassan Gomaa Dec. 1989 49 p Prepared in cooperation with George Mason Univ.
(Contract F19628-90-C-0003)
(AD-A235701; CMU/SEI-CM-22-1-0) Avail: NTIS HC/MF A03
CSCL 09/2

This module describes the concepts and methods used in the software design of real time systems. It outlines the characteristics of real time systems, describes the role of software design in real time system development, surveys and compares some software design methods for real-time systems, and outlines techniques for the verification and validation of real time designs. For each design method treated, its emphasis, concepts on which it is based, steps used in its application, and an assessment of the method are provided. GRA

N91-27798# Carnegie-Mellon Univ., Pittsburgh, PA. Software Engineering Inst.
SOFTWARE CONFIGURATION MANAGEMENT Final Report
James E. Tomayko Dec. 1990 19 p
(Contract F19628-90-C-0003)
(AD-A235702; CMU/SEI-CM-4-1-4) Avail: NTIS HC/MF A03
CSCL 12/5

Software configuration management encompasses the disciplines and techniques of initiating, evaluating, and controlling change to software products during and after the development process. It emphasizes the importance of configuration control in managing software production. Configuration management is an integral part of the software development process across all phases of the life cycle. It functions as a controlling discipline, enabling changes to be made to existing documentation and products in such a way as not to destroy the integrity of the software. Since configuration management extends over the life of the product, and since tools, techniques, and standard exist solely aimed at its proper execution, configuration management can stand alone as a module within a graduate curriculum. The module presented here is intended to be an indepth consideration of configuration management, including configuration item identification, change reporting and evaluation change, execution, tool evaluation and use, version control, and management principles related to configuration control. GRA

N91-27799# Carnegie-Mellon Univ., Pittsburgh, PA. Software Engineering Inst.
STUDYING SOFTWARE ARCHITECTURE THROUGH DESIGN SPACES AND RULES Final Report
Thomas G. Lane Nov. 1990 40 p
(Contract F19628-89-C-0003)
(AD-A235737; CMU/SEI-90-TR-18; ESD-TR-90-219) Avail: NTIS HC/MF A03 CSCL 12/5

This report argues that the overall structure of software systems (software architecture) is usefully studied by constructing design spaces. A design space identifies the key functional and structural choices made in creating a system design, and it classifies the alternatives available for each choice. Rules can be formulated to relate choices within a design space. Sets of such rules are a valuable design aid and offer a promising route to automatic structural design. By codifying design practice, design spaces can also aid software maintenance and training. To support this argument, the report describes a design space and associated rules for user interface software, and it discusses an experimental that validated these design rules by comparing their predictions to real system designs. GRA

N91-27800# Carnegie-Mellon Univ., Pittsburgh, PA. Software Engineering Inst.
HARTSTONE BENCHMARK USER'S GUIDE, VERSION 1.0 Final Report
Patrick Donohoe, Ruth Shapiro, and Nelson Weiderman Mar. 1990 97 p
(Contract F19628-85-C-0003)
(AD-A235740; CMU/SEI-90-UG-1; ESD-90-TR-5) Avail: NTIS HC/MF A05 CSCL 09/2

The Hartstone benchmark is a set of timing requirements for testing a System's ability to handle hard real time applications. It is specified as a set of processes with well-defined workloads and timing constraints. The name Hartstone derives from HArd Real Time and the fact that the workloads are presently based on the well-known Whetstone benchmark. This report describes the structure and behavior of an implementation in the Ada programming language of one category of Hartstone requirements, the Periodic Harmonic (PH) Test Series. The Ada implementation of the PH series is aimed primarily at real-time embedded processors where the only executing code is the benchmark and the Ada runtime system. Guidelines for performing various Hartstone experiments and interpreting the results are provided. Also included are the source code listings of the benchmark,information on how to obtain the source code in machine-readable form, and some sample results for Version 1.0 of the Systems Designers XD Ada VAX/VMS - MC68020 cross-compiler. GRA

N91-27801# Carnegie-Mellon Univ., Pittsburgh, PA. Software Engineering Inst.
PROSPECTS FOR AN ENGINEERING DISCIPLINE OF SOFTWARE Final Report
Mary Shaw Sep. 1990 30 p
(Contracts F19628-90-C-0003; F33615-87-C-1499; ARPA Order 4976)
(AD-A235751; CMU/SEI-90-TR-20; ESD-TR-90-221) Avail: NTIS HC/MF A03 CSCL 12/5

Software engineering is not yet a true engineering discipline, but it has the potential to become one. Older engineering fields offer glimpses of the character software engineering might have. From these hints and an assessment of the current state of software practice, we can project some characteristics software engineering will have and suggest some steps toward an engineering discipline of software. The term software engineering was coined in 1968 as a statement of aspiration. That year NATO convened a workshop by that name to assess the state and prospects of software production NATO 69. Capturing the imagination of software developers, the phrase achieved popularity during the 1970s. It now refers to a collection of management processes, software tooling, and design activities for software development. The resulting practice, however, differs significantly

from the practice of older forms of engineering. This paper begins by examining the usual practice of engineering and the way it has evolved in other disciplines. This discussion provides a historical context for assessing the current practice of software production and setting out an agenda for attaining an engineering practice. GRA

N91-27802# Carnegie-Mellon Univ., Pittsburgh, PA. Software Engineering Inst.
GENERIC AVIONICS SOFTWARE SPECIFICATION Final Report
C. D. Locke, D. R. Vogel, Lee Lucas, and John B. Goodenough Dec. 1990 35 p
(Contract F19628-90-C-0003)
(AD-A235752; CMU/SEI-90-TR-8; ESD-TR-90-209) Avail: NTIS HC/MF A03 CSCL 12/5

This report informally specifies the general functions, data interactions, and timing constraints for a hypothetical avionics mission control computer (MCC) system typical of those found in some existing U.S. Navy and Marine Corps aircraft. Avionics functions and equipment are described only to the extent needed to specify generic MCC behavior. The specification was developed primarily to exemplify timing requirements and functional interactions in a heavily loaded real time system. The devices, functions, and architecture presented here were prepared for illustrative purposes and are not those of any specific military aircraft. In particular, the quantitative timing information and discussion of functional interactions is hypothetical. The specification consists of an introductory description of the environment in which the mission computer operates followed by a functional description of the requirements imposed on the mission computer. The functional description is minimal and serves mainly to characterize computer workload and data interactions. An appendix contains a summary of the timing requirements together with an analysis of the expected CPU load for a possible attack scenario. GRA

N91-27803# Carnegie-Mellon Univ., Pittsburgh, PA. Software Engineering Inst.
SPECTRUM OF FUNCTIONALITY IN CONFIGURATION MANAGEMENT SYSTEMS Final Report
Susan Dart Dec. 1990 43 p
(Contract F96289-90-C-0003)
(AD-A235753; CMU/SEI-90-TR-11; ESD-90-TR-212) Avail: NTIS HC/MF A03 CSCL 12/5

The Software Environments Project at the Software Engineering institute has found considerable progress concerning support for software configuration management (CM) in environments and tools. This paper's intent is to highlight a spectrum of features provided by existing CM systems. The spectrum shows features as being extensions or generalizations of other features and these extensions represent the progress. As part of presenting the features, the scope of issues concerning users of CM systems is discussed. No single CM system provides all the functionality required by the different kinds of users of CM systems. Rather, each CM system addresses some part of a spectrum of functionality. To complete the report, several configuration management systems are briefly described. Software CM is a discipline for controlling the evolution of software systems. GRA

N91-27804# IIT Research Inst., Chicago, IL.
ADAPTIVE INTERFACES Final Report, Feb. 1989 - Apr. 1990
Philip Cohen Mar. 1991 55 p Prepared in cooperation with SRI International Corp., Menlo Park, CA
(Contract F30602-87-D-0094)
(AD-A235773) Avail: NTIS HC/MF A04 CSCL 23/2

The Shoptalk system served in this task, as a testbed for integrating Natural Language and graphics techniques. The goals were to: (1) develop a uniform semantics of pointing for devices such as a mouse, (2) develop a multi-modal interface methodology that includes the ability to use Natural Language to describe objects and time periods and the ability to use graphical techniques to manipulate context, and (3) conduct a feasibility demonstration of a prototype adaptive interface. GRA

N91-27805# Carnegie-Mellon Univ., Pittsburgh, PA. Software Engineering Inst.
FORMAL VERIFICATION OF PROGRAMS Final Report
Alfs T. Berztiss and Mark A. Ardis Dec. 1988 32 p
(Contract F19628-89-C-0003)
(AD-A235775; CMU/SEI-CM-20-1-0) Avail: NTIS HC/MF A03 CSCL 09/2

This module introduces formal verification of programs. It deals primarily with proofs of sequential programs, but also with consistency proofs for data types and deduction of particular behaviors of programs from their specifications. Two approaches are considered: verification after implementation that a program is consistent with its specification, and parallel development of a program and its specification. An assessment of formal verification is provided. Central to the development of a program is a requirements statement, which tells in precise terms what the program is to accomplish. Parts of this document can be expressed formally, i.e., in a language that has formally defined syntax and semantics. Other parts cannot be so expressed. The concern here is with the formal component only. This is called the specification of the program, consistent with the usage adopted in Berztiss. Verification demonstrates that a program is consistent with its requirements. Verification can be either formal or informal. All programs have to be verified, but formal verification is not often practicable. Nevertheless, formal verification is highly relevant to practical software engineering. GRA

N91-27806# Carnegie-Mellon Univ., Pittsburgh, PA. Software Engineering Inst.
STARS/USERS WORKSHOP: ISSUES FOR DISCUSSION GROUPS Final Report
Judy Bamberger, ed. Dec. 1990 203 p Workshop held in Pittsburgh, PA, 10-11 Sep. 1990
(Contract F19628-90-C-0003)
(AD-A235776; CMU/SEI-90-TR-32; ESD-90-TR-232) Avail: NTIS HC/MF A10 CSCL 12/5

The STARS (Software Technology for Adaptable, Reliable Systems) Program is focused on providing the DoD software community with a software engineering environment, repository technology, and process models. This STARS Workshop was targeted toward increasing the communication between the STARS Program and the builders of software-dependent systems. This was the first of many public discussions hosted by the STARS program. This workshop was hosted by the SEI. The primary purposes of this workshop were: (1) For organizations building software-dependent systems to review STARS Program goals, objectives, and progress and to provide input into the STARS Program plans; and (2) For the STARS Program to validate its goals, objectives, and plans. This workshop featured: (1) A detailed description of the current direction and technical thrusts of the STARS Program, as well as the key issues/challenges facing it. (2) Small discussion groups, focusing on current hot topics applicable to STARS, such as: reuse, process, software engineering environments, business practices, technology transition, and evaluation of STARS products and technologies. (3) A STARS Program response to the issues raised by the workshop attendees during discussion groups. GRA

N91-27807# Carnegie-Mellon Univ., Pittsburgh, PA. Software Engineering Inst.
APSE INTERACTIVE MONITOR: A SOFTWARE ARTIFACT FOR SOFTWARE ENGINEERING EDUCATION Education Materials Report
Charles B. Engle, Gary Ford, and James E. Tomayko Nov. 1989 21 p
(Contract F19628-90-C-0003)
(AD-A235777; CMU/SEI-89-EM-2) Avail: NTIS HC/MF A03 CSCL 09/2

In 1987 the SEI began a search for a well-documented Ada system, developed under government contract, that could be used

in software engineering education. The APSE Interactive Monitor (AIM) was determined to be appropriate for this purpose. This system acts as an interface between a user of an Ada programming support environment (APSE) and the programs that the user executes in the APSE. It provides facilities to support the concurrent execution of multiple interactive programs, each of which has access to a virtual terminal. Educational uses of the system and described, including use as a case study and as the basis for exercises. Software engineering topics that can be taught with the system include software maintenance, configuration management, software documentation, cost estimation, and object-oriented design. GRA

N91-27808# Carnegie-Mellon Univ., Pittsburgh, PA. Software Engineering Inst.
USER INTERFACE SOFTWARE STRUCTURES Final Report
Thomas G. Lane May 1990 268 p
(Contract F19628-90-C-0003)
(AD-A235778; CMU/SEI-90-SR-13) Avail: NTIS HC/MF A12 CSCL 12/5

This document codifies the structural choices faced by designers of user interface software. It shows how these choices can be based on system requirements. Much work can be saved if one can learn to re-use structural designs. Instead of deriving every design from first principles (e.g., design by top-down decomposition), we should be able to choose among known solutions with known properties. This thesis works towards organizing design knowledge to make routine design possible at the level of system structure. The report begins by analyzing existing user interface systems. Patterns of structural choices and functional properties are extracted to form a design space for user interface structures. Each dimension of this space represents either a key structural choice or a functional requirement that influences structure. The thesis constructs a mechanical set of rules that select appropriate structural choices given values for functional dimensions. These rules are experimentally tested by comparing their predictions to the designs of a fresh set of systems. The rules achieve substantial correlation with the actual choices of these designs; moreover, many of the differences represent reasonable alternative choices. This experiment demonstrates first that the design space can successfully describe systems other that those it was based on, and second that there are usable correlations between the functional and structural dimensions of the space. GRA

N91-27809# Carnegie-Mellon Univ., Pittsburgh, PA. Software Engineering Inst.
SOFTWARE MAINTENANCE EXERCISES FOR A SOFTWARE ENGINEERING PROJECT COURSE Final Report
Charles B. Engle, Gary Ford, and Tim Korson Feb. 1989 161 p
(Contract F19628-90-C-0003)
(AD-A235779; CMU/SEI-89-EM-1) Avail: NTIS HC/MF A08 CSCL 09/2

Software maintenance is an important task in the software industry and thus an important part of the education of a software engineer. It has been neglected in education, partly because of the difficulty of preparing a software system upon which maintenance can be performed. This report provides an operational software system of 10,000 lines of Ada and several exercises based on that system. Concepts such as configuration management, regression testing, code reviews, and stepwise abstraction can be taught with these exercises. GRA

N91-27810# Carnegie-Mellon Univ., Pittsburgh, PA. Software Engineering Inst.
RATIONALE FOR SQL Ada MODULE DESCRIPTION LANGUAGE SAMeDL Final Report
Gary J. Chastek, Marc H. Graham, and Gregory Zelesnik Mar. 1991 66 p
(Contract F19628-90-C-0003)
(AD-A235780; CMU/SEI-91-TR-4; ESD-91-TR-4) Avail: NTIS HC/MF A04 CSCL 12/5

The lack of an acceptable standard interface between the programming language Ada and the database language Structured Query Languages (SQL) is the greatest impediment to the further spread of Ada. The SQL Ada Module Description Language, the SAMeDL, was designed to fill this gap. The SAMeDL is described and the ideas on which it is based is explained. The SQL Ada Module Description Language, SAMeDL, is a language for the specification of Abstract interfaces as delineated by the SQL Ada Module Extensions (SAME) methodology. This is a companion to the Reference Manual. Whereas the Reference Manual is meant to be precise, the Rationale is meant to be clear. An explanation of the problem solved by the SAMeDL is given. The creation of a new language is justified and the underlying principles of that language are described. Crucial issues in the language are then explained. These include: (1) The form and meaning of identifiers in the SAMeDL; (2) The role of and procedures for data definition in the SAMeDL (This includes support for enumerations and constants in the SAMeDL); and (3) The typing rules of the SAMeDL. The proposed use of some SAMeDL features is also illustrated. These include Standard Post Processing and User Defined Base Domains. GRA

N91-27811# Carnegie-Mellon Univ., Pittsburgh, PA. Software Engineering Inst.
THE SQL Ada MODULE DESCRIPTION LANGUAGE SAMeDL Final Report
Gary J. Chastek, Marc H. Graham, and Gregory Zelesnik Nov. 1990 128 p
(Contract F19628-90-C-0003)
(AD-A235781; CMU/SEI-90-TR-26; ESD-90-TR-227) Avail: NTIS HC/MF A07 CSCL 12/5

A reference manual is presented for the SQL Ada Module Description Language (SAMeDL). The SAMeDL is used to describe database services needed by Ada application programs. The Structured Query Language (SQL) Ada Module Description Language (SAMeDL) automates the construction of software designed to use the SQL Ada Module Extensions application architecture. Such applications are, in particular, written in Ada and use data-base management systems (DBMS) whose data manipulation language is SQL. The meaning of a SAMeDL compilation unit is given by: (1) An SQL module, conforming to the SQL standard, possibly with DBMS implementation-specific extensions; (2) An Ada compilation unit, conforming to the Ada standard; and (3) Rules concerning the relationship between the SQL and Ada texts. The goal of the SQL Ada Module Extensions (SAME) is to produce robust database application programs written in a style suitable to Ada. The goal of the SAMeDL is to provide a binding of Ada and SQL based upon the SAME. A style suitable to Ada means that an interface generated by the SAMeDL views the interaction between the application program and the database as a design object, separating database knowledge from the application program, and thereby yielding the potential for increased specialization of software development. GRA

N91-27812# Carnegie-Mellon Univ., Pittsburgh, PA. Software Engineering Inst.
CONFIGURATION MANAGEMENT MODELS IN COMMERCIAL ENVIRONMENTS Final Report
Peter H. Feiler Mar. 1991 61 p
(Contract F19628-90-C-0003)
(AD-A235782; CMU/SEI-91-TR-7; ESD-91-TR-7) Avail: NTIS HC/MF A04 CSCL 12/5

A number of advances can be observed in recent commercial software development environments in support of configuration management (CM). These advances include: configurations as managed objects; transparent access to repositories; and, in addition to the familiar checkout/checkin model, three CM models based on configurations. These CM models are the composition model, the long transaction model, and the change set model. Typically, one or two of the models can be found in a system. The models are analyzed with respect to their potential impact on the software development process, resulting in several observations. Some of the models exist in a number of variations,

each impacting the software process differently. CM capabilities can be found not only in CM tools and environment frameworks, but also in development tools. Integration of such tools into environments raises the need for different CM models to interoperate. Therefore, it is desirable to evolve to a unified CM model that encompasses the full range of CM concepts and can be adapted to different process needs. GRA

N91-27813# Carnegie-Mellon Univ., Pittsburgh, PA. Software Engineering Inst.
INFORMATICS FOR A NEW CENTURY: COMPUTING EDUCATION FOR THE 1990S AND BEYOND Final Report
Mary Shaw Jul. 1990 26 p
(Contract F19628-90-C-0003)
(AD-A235783; CMU/SEI-90-TR-15; ESD-90-TR-216) Avail: NTIS HC/MF A03 CSCL 05/2

Information technology and computer science have not only reshaped computation, communication, and commerce; they have expanded the basic models and paradigms of many disciplines. Informatics education has obligations to all the communities that rely on information technology, not just the computing professionals. Serving this extended audience well requires changes in the content and presentation of computing curricula. The coming needs are sketched for information processing and the populations are analyzed that will require informatics education. Curriculum requirements are considered through two examples, one outside the traditional boundary of computer science and one inside. GRA

N91-27814# Carnegie-Mellon Univ., Pittsburgh, PA. Software Engineering Inst.
SOFTWARE ENGINEERING PROCESS GROUP GUIDE Final Report
Priscilla Fowler and Stan Rifkin Sep. 1990 155 p
(Contract F19628-90-C-0003)
(AD-A235784; CMU/SEI-90-TR-24; ESD-90-TR-225) Avail: NTIS HC/MF A08 CSCL 12/5

Improving the process of software systems development and maintenance is the most reliable way to improve product quality. Guidance is offered on how to establish a software engineering process group (SEPG) and related software engineering process improvement functions. The process group works with line organizations to improve process quality by helping to assess current status, plan and implement improvements, and transfer technology to facilitate improvement in practice. GRA

N91-27815# Carnegie-Mellon Univ., Pittsburgh, PA. Software Engineering Inst.
FEATURE-ORIENTED DOMAIN ANALYSIS (FODA) FEASIBILITY STUDY Final Report
Kyo C. Kang, Sholom G. Cohen, James A. Hess, William E. Novak, and A. S. Peterson Nov. 1990 159 p
(Contract F19628-90-C-0003)
(AD-A235785; CMU/SEI-90-TR-21; ESD-90-TR-222) Avail: NTIS HC/MF A08 CSCL 12/5

Successful Software reuse requires the systematic discovery and exploitation of commonality across related software systems. By examining related software systems and the underlying theory of the class of systems they represent, domain analysis can provide a generic description of the requirements of that class of systems and a set of approaches for their implementation. Methods are established for performing a domain analysis and the products are described of the domain analysis process. To illustrate the application of domain analysis to a representative class of software systems, a domain analysis is provided of window management system software. GRA

N91-27816# Ohio State Univ., Columbus. Electroscience Lab.
IMPLEMENTATION AND EVALUATION OF A CLASSIFICATION ALGORITHM BASED ON STRUCTURAL DESCRIPTIONS: PROGRAM LISTING
Paul B. Silverstein Dec. 1990 88 p Prepared in cooperation with General Dynamics/Fort Worth, TX
(Contract N00014-90-J-1200)
(AD-A235814; ESL-529819-7; ESL-723090-4) Avail: NTIS HC/MF A05 CSCL 12/5

The following LISP program listing was used to obtain the results displayed in a previous report. During the research phase of this project, a few changes in terminology occurred. While the previous report reflects the new nomenclature, some of the old terms still exist in the classifier's LISP code. The table below resolves the differences in terminology between Technical Report 529819-6/723090-3 and the LISP program in this report: (1) Report-mode, pole, complex amplitude; (2) Program-pole, root, residue. GRA

N91-27817# Information Systems and Technology Center, Wright-Patterson AFB, OH. Validat Ion Facility.
MERIDIAN SOFTWARE SYSTEMS, INC., MERIDIAN Ada, VERSION 4.1, APPLE MACINTOSH 2 (HOST AND TARGET), 900909W1.11038.032 Final Report
8 Apr. 1991 36 p Sponsored by DOD
(AD-A235827) Avail: NTIS HC/MF A03 CSCL 12/5

This Validation Summary Report describes the extent to which a specific Ada compiler conforms to the Ada Standard, ANSI/MIL-STD-1815A. This report explains all technical terms used within it and thoroughly reports the results of testing this compiler using the Ada Compiler Validation Capability. An Ada compiler must be implemented according to the Ada Standard, and any implementation-dependent features must conform to the requirements of the Ada Standard. The Ada Standard must be implemented in its entirety, and nothing can be implemented that is not in the Standard. Even though all validated Ada compilers conform to the Ada Standard, it must be understood that some differences do exist between implementations. The Ada Standard permits some implementation dependencies--for example, the maximum length of identifiers or the maximum values of integer types. Other differences between compilers result from the characteristics of particular operating systems, hardware, or implementation strategies. All the dependencies observed during the process of testing this compiler are given in this report. The information in this report is derived from the test results produced during validation testing. The validation includes submitting a suite of standardized tests, the ACVC, as inputs to an Ada compiler and evaluating the results. GRA

N91-27818# Information Systems and Technology Center, Wright-Patterson AFB, OH. Validat Ion Facility.
MERIDIAN SOFTWARE SYSTEMS, INC., MERIDIAN Ada, VERSION 4.1, SUN MICROSYSTEMS 4/110 (HOST AND TARGET), 900909W1.11032 Final Report
8 Apr. 1991 33 p Sponsored by DOD
(AD-A235828) Avail: NTIS HC/MF A03 CSCL 12/5

This Validation Summary Report describes the extent to which a specific Ada compiler conforms to the Ada Standard, ANSI/MIL-STD-1815A. This report explains all technical terms within it and thoroughly reports the results of testing this compiler using the Ada Compiler Validation Capability. An Ada compiler must be implemented according, to the Ada Standard, and any implementation-dependent features must conform to the requirements of the Ada Standard. The Ada Standard must be implemented in its entirety, and nothing can be implemented that is not in the Standard. Even though all validated Ada compilers conform to the Ada Standard, it must be understood that some differences do exist between implementations. The Ada Standard permits some implementation dependencies--for example, the maximum length of identifiers or the maximum values of integer types. Other differences between compilers result from the characteristics of particular operating systems, hardware, or implementation strategies. All the dependencies observed during the process of testing this compiler are given in this report. The information in this report is derived from the test results produced during validation testing. The validation process includes submitting a suite of standardized tests, the ACVC, as inputs to an Ada compiler and evaluating the results. GRA

N91-27819# Information Systems and Technology Center, Wright-Patterson AFB, OH. Validat Ion Facility.
MERIDIAN SOFTWARE SYSTEMS, INC., MERIDIAN Ada, VERSION 4.1, DECSTATION 3100 (HOST AND TARGET), 900909W1.110033 Final Report
8 Apr. 1991 33 p Sponsored by DOD
(AD-A235829) Avail: NTIS HC/MF A03 CSCL 12/5

This Validation Summary Report describes the extent to which a specific Ada compiler conforms to the Ada Standard, ANSI/MIL-STD-1815A. This report explains all technical terms used within it and thoroughly reports the results of testing this compiler using the Ada Compiler Validation Capability. An Ada compiler must be implemented according to the Ada Standard, and any implementation-dependent features must conform to the requirements of the Ada Standard. The Ada Standard must be implemented in its entirety, and nothing can be implemented that is not in the Standard. Even though all validated Ada compilers conform to the Ada Standard, it must be understood that some differences do exist between implementations. The Ada Standard permits some implementation dependencies--for example, the maximum length of identifiers or the maximum values of integer types. Other differences between compilers result from the characteristics of particular operating systems, hardware, or implementation strategies. All the dependencies observed during the process of testing this compiler are given in this report. The information in this report is derived from the test results produced during the validation testing. The validation process includes submitting a suite of standardized tests, the ACVC, as inputs to an Ada compiler and evaluating the results. GRA

N91-27820# Information Systems and Technology Center, Wright-Patterson AFB, OH. Validat Ion Facility.
MERIDIAN SOFTWARE SYSTEMS, INC., MERIDIAN Ada, VERSION 4.1, IBM PS/2 60 (HOST AND TARGET), 900909W1.11034 Final Report
8 Apr. 1991 36 p Sponsored by DOD
(AD-A235830) Avail: NTIS HC/MF A03 CSCL 12/5

This Validation Summary Report describes the extent to which a specific Ada compiler conforms to the Ada Standard, ANSI/MIL-STD-1815A. This report explains all technical terms used within it and thoroughly reports the results of testing this compiler using the Ada Compiler Validation Capability. An Ada compiler must be implemented according to the Ada Standard, and any implementation-dependent features must conform to the requirements of the Ada Standard. The Ada Standard must be implemented in its entirety, and nothing can be implemented that is not in the Standard. Even though all validated Ada compilers conform to the Ada Standard, it must be understood that some differences do exist between implementations. The Ada Standard permits some implementation dependencies--for example, the maximum length of identifiers or the maximum values of integer types. Other differences between compilers result from the characteristics of particular operating systems, hardware, or implementation strategies. All the dependencies observed during the process of testing this compiler are given in this report. The information in this report is derived from the test results produced during validation testing. The validation process includes submitting a suite of standardized tests, the ACVC, as inputs to an ADA compiler and evaluating the results. GRA

N91-27821# Information Systems and Technology Center, Wright-Patterson AFB, OH. Validat Ion Facility.
MERIDIAN SOFTWARE SYSTEMS, INC., MERIDIAN Ada, VERSION 4.1, IBM PS/2 30 (HOST AND TARGET), 900909W1.11035 Final Report
8 Apr. 1991 37 p Sponsored by DOD
(AD-A235831) Avail: NTIS HC/MF A03 CSCL 12/5

This Validation Summary Report describes the extent to which a specific Ada compiler conforms to the Ada Standard, ANSI/MIL-STD-1815A. This report explains all technical terms used within it and thoroughly reports the results of testing this compiler using the Ada Compiler Validation Capability. An Ada compiler must be implemented according to the Ada Standard, and any implementation-dependent features must conform to the requirements of the Ada Standard. The Ada Standard must be implemented in its entirety, and nothing can be implemented that is not in the Standard. Even though all validated Ada compilers conform to the Ada Standard, it must be understood that some differences do exist between implementations. The Ada Standard permits some implementation dependencies--for example, the maximum length of identifiers or the maximum values of integer types. Other differences between compilers result from the characteristics of particular operating systems, hardware, or implementation strategies. All the dependencies observed during the process of testing this compiler are given in this report. The information in this report is derived from the test results produced during validation testing. The validation process includes submitting a suite of standardized tests, the ACVC, as inputs to an Ada compiler and evaluating the results. GRA

N91-27822# Information Systems and Technology Center, Wright-Patterson AFB, OH. Validat Ion Facility.
MERIDIAN SOFTWARE SYSTEMS, INC., MERIDIAN Ada, VERSION 4.1, 80 DATA 386/25 (HOST AND TARGET), 900909W1.11037 Final Report
8 Apr. 1991 32 p Sponsored by DOD
(AD-A235832) Avail: NTIS HC/MF A03 CSCL 12/5

This Validation Summary Report describes the extent to which a specific Ada compiler conforms to the Ada Standard, ANSI/MIL-STD-1815A. This report explains all technical terms used within it and thoroughly reports the results of testing this compiler using the Ada Compiler Validation Capability. An Ada compiler must be implemented according to the Ada Standard, and any implementation-dependent features must conform to the requirements of the Ada Standard. The Ada standard must be implemented in its entirety, and nothing can be implemented that is not in the Standard. Even though all validated Ada compilers conform to the Ada Standard, it must be understood that some differences do exist between implementations. The Ada Standard permits some implementation dependencies--for example, the maximum length of identifiers or the maximum values of integer types. Other differences between compilers result from the characteristics of particular operating systems, hardware, or implementation strategies. All the dependencies observed during the process of testing this compiler are given in this report. The information in this report is derived from the test results produced during validation testing. The validation process includes submitting a suite of standardized tests, the ACVC, as inputs to an Ada compiler and evaluating the results. GRA

N91-27823# Information Systems and Technology Center, Wright-Patterson AFB, OH. Validat Ion Facility.
MERIDIAN SOFTWARE SYSTEMS, INC., MERIDIAN Ada, VERSION 4.1, ITT XTRA/286 (HOST AND TARGET), 900909W1.11036 Final Report
8 Apr. 1991 36 p Sponsored by DOD
(AD-A235833) Avail: NTIS HC/MF A03 CSCL 12/5

This Validation Summary Report describes the extent to which a specific Ada compiler conforms to the Ada Standard, ANSI/MIL-STD-1815A. This report explains all technical terms used within it and thoroughly reports the results of testing this compiler using the Ada Compiler Validation Capability. An Ada compiler must be implemented according to the Ada Standard, and any implementation-dependent features must conform to the requirements of the Ada Standard. The Ada Standard must be implemented in its entirety, and nothing can be implemented that is not in the Standard. Even though all validated Ada compilers conform to the Ada Standard, it must be understood that some differences do exist between implementations. The Ada Standard permits some implementation dependencies--for example, the maximum length of identifiers or the maximum values of integer types. Other differences between compilers result from the characteristics of particular operating systems, hardware, or implementation strategies. All the dependencies observed during the process of testing this compiler are given in this report.

GRA

N91-27824# Carnegie-Mellon Univ., Pittsburgh, PA. Software Engineering Inst.
SUPPORT MATERIALS FOR USER INTERFACE DEVELOPMENT Final Report
Gary Perlman Apr. 1988 38 p
(Contract F19628-90-C-0003)
(AD-A235835; CMU/SEI-SM-17-1-0) Avail: NTIS HC/MF A03 CSCL 09/2

In the curriculum module User Interface Development, SEI-CM-17 (CM-17), teaching consideration is introduced into the body of the annotated outline, in the form of special annotations. These annotations, set off in distinctive type, offer teaching suggestions, recommend classroom demonstrations, and indicate where slides, provided in this document, may be used. Currently, only transparency masters for the first of the three major sections of the curriculum module, User Interface Design, are being provided. If there is sufficient interest in the user community for these materials, it is anticipated that transparency masters for the latter two sections of CM-17 (User Interface Implementation and User Interface Evaluation) will also be provided in the future. Users of SEI curriculum materials are urged to report on their experiences with curriculum modules and support materials. Specifically, comments on the usefulness of the teaching notes and the desirability of additional transparency masters will be greatly appreciated. GRA

N91-27825# California Univ., Davis. Dept. of Electrical and Computer Engineering.
FAULT TOLERANCE IN OPTO-ELECTRONIC COMPUTING Semiannual Report, 1 Oct. 1990 - 1 Apr. 1991
Ting-Ting Y. Lin 25 Apr. 1991 8 p
(Contract N00014-91-J-1017)
(AD-A235881) Avail: NTIS HC/MF A02 CSCL 12/7

Water scale integration (WSI) promises to realize a complete multiprocessing system on the same wafer and eliminates the expensive steps required to dice and bond. The fundamental belief is that the internal connection between chips on the same wafer are more reliable and have a smaller propagation delay than external connections. However, achieving a high yield has proven to be a major challenge. Rather than aiming for 100 pct. yield, the realistic solution is to determine the defective components on the wafer and replace them with spares. Which means, the design should be tolerant to faults developed during the manufacturing process. Moreover, faults occur during system operation, be it component failure, improper operation, or environmental factors. Therefore, a means to detect these unexpected faults and recover from them is necessary to minimize down time and unavailability. Long and periodic system downs are a luxury that cannot be afforded for computers used in critical applications. It is shown that the introduction of optical interconnection techniques into a multiprocessor environmental (e.g., the Programmable Opto-electronic Multiprocessor, POEM) enables efficient implementation of fault-tolerant techniques. GRA

N91-27826# Boise State Univ., Idaho.
DISTRIBUTED TRAINING TECHNOLOGY COST ANALYSIS TEMPLATES (TTCATS): USER'S MANUAL Final Report, Feb. 1987 - Feb. 1989
Joseph D. Hagman and Dewey I. Dykstra, Jr. Jan. 1991 39 p
(Contract DE-AC07-76ID-01570)
(AD-A235893; ARI-RN-91-26) Avail: NTIS HC/MF A03 CSCL 12/5

This manual is a guide for the Training Technology Cost Analysis Templates (TTCATS) software program. TTCATS contains seven individual subprograms, or templates, that customize the LOTUS 1-2-3 spreadsheet to help project the cost of delivering training to geographically distributed locations. The cost estimates pertain either to delivery method and equipment configurations that have been independently determined to be appropriate for an anticipated application or to configurations recommended by a companion expert-system-based software program called TECHSELECT. The first six TTCATS templates calculate costs for a variety of distributed training delivery method and equipment configurations: asynchronous delivery via computer-based training with desktop microcomputers, asynchronous delivery via computer-based training with portable or laptop microcomputers, asynchronous delivery via computer conferencing, synchronous delivery via audio conferencing, synchronous delivery via video conferencing with land-based microwave communications, and synchronous delivery via video conferencing with satellite-based communications. The last template calculates the cost of transporting trainees to a central training site. GRA

N91-27827# Hatfield Polytechnic (England). Numerical Optimisation Centre.
OPTIMISATION ALGORITHMS FOR HIGHLY PARALLEL COMPUTER ARCHITECTURES Final Draft Report
L. C. Dixon and R. C. Price Dec. 1990 76 p
(Contract DAJA45-87-C-0038)
(AD-A235911; R/D-5850-MA-01) Avail: NTIS HC/MF A05 CSCL 12/6

The design is considered of optimization algorithms to run efficiently on highly parallel computer architectures. Most efficient optimization algorithms require the calculation of first and possibly second derivatives of the objective function and where present the constraints. This task normally dominates all other tasks undertaken in solving a large sized problem. The other main task is usually the solution of a set of linear equations. The experience is described of solving these two tasks on parallel computer architecture. A sparse forward implementation of doublet and triplet automatic differentiation is described that enables both the gradient and hessian of objective functions to be accurately and cheaply solved. It is shown that when the function is partially separable this can be performed very effectively on a parallel machine. The effect of solving sets of linear equations on a parallel system is also described, and the two then combined in effective algorithms for both unconstrained and constrained optimization. GRA

N91-27828# California Univ., Los Angeles. Dept. of Computer Science.
A COMPARATIVE ASSESSMENT OF SYSTEM DESCRIPTION METHODOLOGIES AND FORMAL SPECIFICATION LANGUAGES Final Technical Report, Sep. 1989 - Sep. 1990
Algirdas Avizienis and Chi-Sharn Wu Mar. 1991 61 p
(Contract F30602-88-D-0026)
(AD-A235923; RL-TR-91-18) Avail: NTIS HC/MF A04 CSCL 12/7

A classification of formal specification techniques which is useful for the comparative assessment of computer systems is presented. In this classification, formal specification techniques are grouped into three approaches; operational, definitional and hybrid. Depending on whether data abstraction or sequencing is emphasized, the operational and definitional approaches both can be further partitioned into two schools: data paradigm and process paradigm. Five categories are identified, and some representative formal specification techniques in each category are surveyed. A comparative assessment over these specification techniques is given based on a set of criteria, such as usability, verifiability, support for nonfunctional requirements, etc. Experience in using formal specification techniques are discussed. A real time extension of the VDM method, designated RT-VDM, is presented as the most promising approach for further study. Additional recommendations for further study are also made. GRA

N91-27829# Carnegie-Mellon Univ., Pittsburgh, PA. Software Engineering Inst.
ASSURANCE OF SOFTWARE QUALITY Final Report
Bradley J. Brown Jul. 1987 24 p
(Contract F19628-90-C-0003)
(AD-A235924; CMU/SEI-CM-7-1-1) Avail: NTIS HC/MF A03 CSCL 09/2

This module presents the underlying philosophy and associated principles and practices related to the assurance of software quality. It includes a description of the assurance activities associated with the phases of the software development life cycle (e.g., requirements, design, test, etc.). This module presents the concepts

underlying the assurance of software quality as a function of the software development process. Specifically, this module provides: (1) a basic understanding of the concept of quality as it relates to software; (2) an explanation of the concept of software quality assurance as it relates to the software development process; (3) an overview of the industry and government standards related to software; (4) an examination of processes related to software defect reporting, resolution, and analysis; (5) an explanation of requirements traceability and correlation, and the use of traceability to demonstrate of satisfaction of requirements; (6) an examination of methods used to document assurance activities; and (7) an examination of the social factors involved in influencing the actions of persons despite an adversarial relationship. GRA

N91-27830# Carnegie-Mellon Univ., Pittsburgh, PA. Software Engineering Inst.
SOFTWARE DEVELOPMENT USING VDM Final Report
Jan S. Pedersen Dec. 1989 25 p
(Contract F19628-89-C-0003)
(AD-A235996; CMU/SEI-CM-16-1-1) Avail: NTIS HC/MF A03 CSCL 09/2

This module introduces the Vienna Development Method (VDM) approach to software development. The method is oriented toward a formal model view of the software to be developed. The emphasis of the module is on formal specification and systematic development of programs using VDM. A major part of the module deals with the particular specification language (and abstraction mechanisms) used in VDM. During the past 10 to 15 years, a number of software development methods have emerged that stress the importance of using formal descriptions of the systems to be developed. The VDM is one such method, with many applications in industry. The VDM is a formal, mathematically oriented method for the specification and development of software. The VDM is a model-based method. Its main idea is that of giving descriptions of software systems as models. Models are specified as objects and operations on (or functions between) objects, where the objects represent input, output, and internal state of the software system. Classes of objects are explicitly defined as so-called domains, which correspond to types in a programming language. GRA

N91-27831# Mission Research Corp., Santa Barbara, CA.
ANALYSIS OF IR CELESTIAL SURVEY EXPERIMENT Final Report, 21 Jul. 1986 - 30 Oct. 1989
R. M. Korte, J. P. Kennealy, R. A. Gonsalves, and C. Wong Oct. 1989 214 p
(Contract F19628-86-C-0147)
(AD-A235997; GL-TR-89-0265) Avail: NTIS HC/MF A10 CSCL 09/2

A new computer efficient, entropy-based filter for spatial resolution improvement in images has been developed. The method, Filtered Entropy Restoration, has been applied to images constructed from Infra-Red Astronomical Satellite (IRAS) telescope data. The restored images typically exhibit a factor of four improvement in spatial resolution. This work required development of a compute-efficient image construction algorithm, as the IRAS data is not in image format. Image construction required several important preprocessing steps. Development of FIER, image construction, and pre-processing algorithms are all described. The IRAS, and the IRAS mission, a joint undertaking of the United States (50 percent), the Netherlands (40 percent), and Great Britain (10 percent). The IRAS was launched on 26 January 1983 and collected IR sky data continuously from 9 February 1983 through 23 November 1983, at which time the cryogen had been depleted. The primary IRAS objective was to perform a complete, very sensitive survey of the entire sky in four wavelength bands centered at 12, 25, 60, and 100 micron (also referred to as IRAS Bands 1, 2, 3, and 4 respectively). Completeness of the IRAS survey was limited only by interruptions during passages through the South Atlantic Anomaly and a lunar avoidance strategy which was necessary to minimize thermal loading. GRA

N91-27832# Stanford Univ., CA. Dept. of Computer Science.
DEDUCTIVE PROGRAMMING SYNTHESIS Final Technical Report, 10 Nov. 1988 - 28 Feb. 1990
Zohar Manna Feb. 1991 14 p
(Contract N00039-84-C-0211; DARPA Order 6177)
(AD-A236001) Avail: NTIS HC/MF A03 CSCL 12/5

Program synthesis is the systematic derivation of a computer program to meet a given specification. The specification is a general description of the purpose of the desired program, while the program is a detailed description of a method for achieving that purpose. The method is based on a deductive approach, in which the problem of deriving a program is regarded as one of proving a mathematical theorem. The theorem expresses the existence of an object meeting the specified conditions. The proof is restricted to be sufficiently constructive to indicate a method for finding the desired output. That method becomes the basis for a program, which is extracted from the proof. The emphasis of the work has been on automating the program derivation process as much as possible. Theorem proving methods particularly well-suited to the program synthesis application have been developed. An interactive program derivation system has been implemented. Applications to database management and planning have been investigated. GRA

N91-27833# Electronics Research Lab., Adelaide (Australia).
REPORT ON m-EVES
Jim Grundy Mar. 1991 51 p
(AD-A236014; ERL-0545-RR; DODA-AR-006-482) Avail: NTIS HC/MF A04 CSCL 12/5

This report reviews the verification tool m-EVES (Environment for Verifying and Evaluating Software). It describes the two main components of m-EVES: the language, m-Verdi and the theorem prover, m-NEVER. The main purpose of this report is to describe how problems are attacked in m-EVES, and draw conclusions about the strengths and weaknesses of m-Verdi and m-NEVER. Where appropriate, comparisons are made with other program verification and theorem proving environments. GRA

N91-27834# Electronics Research Lab., Adelaide (Australia).
N REASONS WHY PRODUCTION-RULES ARE INSUFFICIENT MODELS FOR EXPERT SYSTEM KNOWLEDGE REPRESENTATION SCHEMES
S. J. Cosgrove Feb. 1991 21 p
(AD-A236015; ERL-0520-RR; DODA-AR-006-420) Avail: NTIS HC/MF A03 CSCL 12/5

The majority of expert system shells and fully developed expert system packages are founded upon simple observation and hypothesis production-rules. This paper investigates the use of such knowledge representation schemes by analysis of a simple, incomplete plant classification expert system. Furthermore, a new hierarchical knowledge representation scheme known as the n-Cube, which is suitable for classification applications, is discussed with reference to the disadvantages of rule-based systems. GRA

N91-27835# Army Military Personnel Center, Alexandria, VA.
AN ALGORITHM FOR SOLVING A CLASS OF PSEUDO-BOOLEAN EQUATIONS M.S. Thesis Final Report
Kevin J. Loy 25 Feb. 1991 122 p
(AD-A236023) Avail: NTIS HC/MF A06 CSCL 12/4

A new algorithm named the Overall Algorithm is applicable to a 0-1 variable (Pseudo-Boolean) system of equations with an objective function and a set of inequality constraints. The objective equation can be linear or non-linear. The set of constraints must be either all linear or all non-linear independent of the objective function. The Overall Algorithm first solves the objective function and checks the set of constraints for feasibility. If the solution is feasible then the algorithm stops. If the solution is not feasible then the Overall Algorithm moves to the set of constraints and solves the set of constraints for a feasible solution. If there is a solution to the constraints then the Overall Algorithm creates bounds for the optimal solution. This is conjectured through application to 48 previously published problems that are listed in the thesis. The Overall Algorithm is significant because it is an

alternative method for the solution of Pseudo-Boolean systems of equations or models. It is a simple algorithm that, based on computational experience, has been shown to be surprisingly accurate. Finally, the most iterations required for this algorithm is n, where n is the number of variables. GRA

N91-27836# Information Systems and Technology Center, Wright-Patterson AFB, OH. Validation Facility.
MERIDIAN SOFTWARE SYSTEMS, INC., MERIDIAN Ada, VERSION 4.1, SUN MICROSYSTEM 3/260 (HOST AND TARGET), 900909W1.11031 Final Report
8 Apr. 1991 32 p Sponsored by DOD
(AD-A236053) Avail: NTIS HC/MF A03 CSCL 12/5

This Validation Summary Report describes the extent to which a specific Ada compiler conforms to the Ada Standard, ANSI/MIL-STD-1815A. This report explains all technical terms used within it and thoroughly reports the results of testing this compiler using the Ada Compiler Validation Capability. An Ada compiler must be implemented according to the Ada Standard, and any implementation dependent features must conform to the requirements of the Ada Standard. The Ada Standard must be implemented in its entirety, and nothing can be implemented that is not in the Standard. Even though all validated Ada compilers conform to the Ada Standard, it must be understood that some differences do exist between implementations. The Ada Standard permits some implementation dependencies; for example, the maximum length of identifiers or the maximum values of integer types. Other differences between compilers result from the characteristics of particular operating systems, hardware, or implementation strategies. All the dependencies observed during the process of testing this compiler are given in this report. The information in this report is derived from the test results produced during validation testing. The validation process includes submitting a suite of standardized tests, the ACVC, as inputs to an Ada compiler and evaluating the results. GRA

N91-27837# Aerospace Corp., El Segundo, CA.
USER-DEFINED DATA TYPES IN THE STATE DELTA VERIFICATION SYSTEM (SDVS)
J. V. Cook and J. E. Doner 30 Sep. 1990 18 p
(Contract F04701-88-C-0089)
(AD-A236077; TR-0090(5920-07)-1; SSD-TR-91-08) Avail: NTIS HC/MF A03 CSCL 12/5

This report considers the problem of adapting SDVS to deal with computer programs that involve user-defined data types. Such programs use the data types and supporting functions but typically do not have access to details of the implementation of the data types. Some examples are presented, the solution used in the Boyer-Moore system is discussed, and a description is given of how, with suitable modifications, that solution has been implemented in SDVS. GRA

N91-27838# Carnegie-Mellon Univ., Pittsburgh, PA. Software Engineering Inst.
SOFTWARE ENGINEERING INSTITUTE QUARTERLY UPDATE, JANUARY-MARCH 1991
Mar. 1991 39 p
(AD-A236099; ADE-0401007) Avail: NTIS HC/MF A03 CSCL 12/5

The Software Process Program focuses on improving the process of software development. Projects within the program are assessing the actual practice of software engineering in the defense community, training organizations to gain management control over their software development processes, supporting the use of quantitative methods and measures as a basis for process improvement, and developing improved methods for software process management. Some areas of discussion are as follows: Software Process; Software Engineering Techniques, Real Time Distributed Systems; Software Risk Management; Special Projects; Software Engineering Education; DARPA/STARS Support. GRA

N91-27839# Carnegie-Mellon Univ., Pittsburgh, PA. Software Engineering Inst.
INTRODUCTION TO SOFTWARE VERIFICATION AND VALIDATION Final Report
James S. Collofello Dec. 1988 28 p Prepared in cooperation with Arizona State Univ.
(Contract F19628-90-C-0003)
(AD-A236117; CMU/SEI-CM-13-1-1) Avail: NTIS HC/MF A03

Software verification and validation techniques are introduced and their applicability discussed. Approaches to integrating these techniques into comprehensive verification and validation plans are also addressed. This curriculum module provides an overview needed to understand in-depth curriculum modules in the verification and validation area. This module provides a framework for understanding the application of software verification and validation (V and V) processes throughout the software evolution process. Typical products of this process are identified, along with their possible V and V objectives. The V and V process consists of numerous techniques and tools, often used in combination with one another. Due to the large number of V and V approaches in use, this module cannot address every technique. Instead, it will analyze five categories of V and V approaches. These are: (1) technical reviews; (2) software testing; (3) proof of correctness (program verification); (4) simulation and prototyping; and (5) requirements tracing. GRA

N91-27840# Carnegie-Mellon Univ., Pittsburgh, PA. Software Engineering Inst.
INTRODUCTION TO SOFTWARE DESIGN Final Report
David Budgen Jan. 1989 40 p
(Contract F19628-90-C-0003)
(AD-A236118; CMU/SEI-CM-2-2-1) Avail: NTIS HC/MF A03 CSCL 12/5

This curriculum module provides an introduction to the principles and concepts relevant to the design of large programs and systems. It examines the role and context of the design activity as a form of problem solving process, describes how this is supported by current design methods, and considers the strategies, strengths, limitations, and main domains of application of these methods. Design is an important activity for all except the most trivial of systems. It exerts a major influence upon the other phases of the development process, as well as upon system maintenance. An understanding of design issues and of the techniques available to assist in producing a design is essential background for the software engineer. This module provides an introduction to the topic of software design, including the following major elements: (1) An explanation of the role of the design activity in producing large software-based systems, together with an introduction to the principles that are used to assess the quality of design; (2) An introduction to a range of design representation, together with a description of their uses and limitations; (3) An explanation of the role of a design method in the production of a design and of the design strategies used in software design methods; and (4) An introduction to several examples of design methods and an assessment of their strengths and limitations with respect to different classes of problems. GRA

N91-27841# Carnegie-Mellon Univ., Pittsburgh, PA. Software Engineering Inst.
UNIT TESTING AND ANALYSIS Final Report
Larry J. Morell Apr. 1989 41 p Prepared in cooperation with the College of William and Mary
(Contract F19628-90-C-0003)
(AD-A236119; CMU/SEI-CM-9-1-2) Avail: NTIS HC/MF A03 CSCL 12/5

Program testing and analysis are the most practiced means of verifying that a program possesses the features required by its specification. Testing is a dynamic approach to verification in which code is executed with test data to assess the presence (or absence) of required features. Analysis is a static approach to verification in which required features are detected by analyzing, but not executing, the code. Many analysis techniques have become established technologies with their own substantial literature. So

that they may be given adequate treatment elsewhere, these techniques have been placed outside the scope of this module. Included among these techniques are proof of correctness, safety analysis, and the more open-ended analysis procedures represented by code inspections and reviews. This module focuses on unit-level verification; integration and systems verification are to be covered elsewhere. GRA

N91-27842# Carnegie-Mellon Univ., Pittsburgh, PA. Software Engineering Inst.
MODELS OF SOFTWARE EVOLUTION: LIFE CYCLE AND PROCESS Final Report
Walt Scacchi Oct. 1987 33 p Prepared in cooperation with Univ. of Southern California
(Contract F19628-90-C-0003)
(AD-A236120; CMU/SEI-CM-10-1-0) Avail: NTIS HC/MF A03 CSCL 12/5

This module presents an introduction to models of software system evolution and their role in structuring software development. It includes a review of traditional software life cycle models as well as software process models that have been recently proposed. It identifies three kinds of alternative models of software evolution that focus attention to either the products, production processes, or production settings as the major source of influence. It examines how different software engineering tools and techniques can support life cycle or process approaches. It also identifies techniques for evaluating the practical utility of a given model of software evolution for development projects in different kinds of organizational settings. GRA

N91-27843# Carnegie-Mellon Univ., Pittsburgh, PA. Software Engineering Inst.
SUPPORT MATERIALS FOR THE SOFTWARE TECHNICAL REVIEW PROCESS Final Report
John A. Cross Apr. 1988 84 p Prepared in cooperation with Indiana Univ. of Pennsylvania
(Contract F19628-90-C-0003)
(AD-A236122; CMU/SEI-SM-3-1-0) Avail: NTIS HC/MF A05 CSCL 12/5

The purpose of these support materials is to facilitate the teaching and use of software technical reviews in university courses on software engineering subjects. They are intended to supplement the SEI curriculum module, The Software Technical Review Process (CM-3). Although it was developed for use in a university setting, much of the material is appropriate for the training of professionals as well. The user of this material should consider the variety of ways in which technical review processes may be incorporated into software related curricula. For example: (1) Instruction in review concepts and procedures gives students the necessary foundation for participating in or implementing a technical review process; (2) Software technical reviews may also be used in the teaching of general concepts of software engineering by requiring students to inspect and discuss concrete examples of software development artifacts; (3) Practice in conducting reviews provides students with an essential means of gaining competence as reviewers (Students may be required to conduct reviews within the context of software development projects); and (4) Group reviews give students an opportunity to gain experience and knowledge that will help them improve their effectiveness as team members. Group reviews may be used to provide experience with group interaction, or they may be used as a means of studying group dynamics. GRA

N91-27844# Carnegie-Mellon Univ., Pittsburgh, PA. Software Engineering Inst.
INTELLECTUAL PROPERTY PROTECTION FOR SOFTWARE Final Report
Pamela Samuelson and Kevin Deasy Jul. 1989 58 p Prepared in cooperation with Pittsburgh Univ., School of Law
(Contract F19628-90-C-0003)
(AD-A236125; CMU/SEI-CM-14-2-1) Avail: NTIS HC/MF A04 CSCL 12/5

An overview is provided of the U.S. intellectual property laws that form the framework within which legal rights in software are created, allocated, and enforced. The primary forms of intellectual property protection that are likly to apply to software are copyright, patent, and trade secret laws, which are discussed with particular emphasis on the controversial issues arising in their application to software. Also included is a brief introduction to government software acquisition regulations, trademark, trade dress, and related unfair competition issues that may affect software engineering decisions, and to the Semiconductor Chip Protection Act. Many decisions about the development, distribution, maintenance, and enhancement of software are likely to be affected by constraints imposed by intellectual property laws. Intellectual property law provides a default setting of rights allocation when software is created. Licensing or other contracting arrangements may satisfy those who wish to vary the rights allocation arrangements that these laws create. In order to foresee the appropriate manner in which to develop and distribute software, it is important that software developers understand the framework of legal rights and responsibilities within which arrangements for the licensing or sale of their software products takes place. GRA

N91-27845# Brown Univ., Providence, RI. Dept. of Computer Science.
EFFICIENT PARALLEL ALGORITHMS ON RESTARTABLE FAIL-STOP PROCESSORS
Paris C. Kanellakis and Alex A. Shvartsman 1991 14 p
(Contract N00014-91-J-1613)
(AD-A236249) Avail: NTIS HC/MF A03 CSCL 12/6

We study efficient deterministic executions of parallel algorithms on restartable fail-stop CRCW PRAMs (Concurrent Read Concurrent Write-Parallel Random Access Machine). We allow the PRAM processors to be subject to arbitrary stop failures and restarts, that are determined by on-line adversary, and that result in loss of private memory but do not affect shared memory. For this model, we define and justify the complexity measures of: completed work, where processors are charged for completed fixed-size update cycles, and overhead ratio, which amortizes the work over necessary work and failures. We observe that, on P = N restartable fail-stop processors, the Write-All problem requires omega(N log N) completed work, and this lower bound holds even under the additional assumption that processors can read and locally process the entire shared memory at unit cost. Under this unrealistic assumption we have a matching upperbound. The lower bound also applies to the expected completed work of randomized algorithms that are subject to on line adversaries. Finally, we describe a simple on-line adversary that causes inefficiency in may randomized algorithms. GRA

N91-27846# Navy Personnel Research and Development Center, San Diego, CA.
TROUBLESHOOTING ASSESSMENT AND ENHANCEMENT (TAE) PROGRAM: THEORETICAL, METHODOLOGICAL, TEST, AND EVALUATION ISSUES Technical Report, Oct. 1987 - Mar. 1990
Harry B. Conner and Frank H. Hassebrock Apr. 1991 92 p
(AD-A236401; NPRDC-TN-91-11) Avail: NTIS HC/MF A05 CSCL 05/9

The purpose of the Troubleshooting Assessment and Enhancement (TAE), R and D effort was to develop, test, and evaluate a computerized system to provide the Navy with a troubleshooting assessment and training capability. This technical note presents the results of the literature review, the theoretical and methodological issues that were to be considered, and the proposed test and evaluation plan for the TAE effort. GRA

N91-27847# Navy Personnel Research and Development Center, San Diego, CA.
TROUBLESHOOTING ASSESSMENT AND ENHANCEMENT (TAE) PROGRAM: DESIGN, DEVELOPMENT, AND ADMINISTRATION, VOLUME 1 Technical Report, Oct. 1987 - Mar. 1990
Harry B. Conner, Cathryn Poirier, Randy Ulrich, and Thomas Bridges Apr. 1991 153 p

(AD-A236411; NPRDC-TN-91-12-Vol-1) Avail: NTIS HC/MF A08 CSCL 05/9

The purpose of the Troubleshooting Assessment and Enhancement (TAE) R and D effort was to develop, test, and evaluate a low cost, microcomputer based system to provide an objective measurement of the troubleshooting proficiency of Navy technicians. The results are presented of the design and development effort. It provides the system requirements, program design description, TAE software, and the TAE administration guide. GRA

N91-27848# National Computing Centre Ltd., Manchester (England).
Ada COMPILER VALIDATION SUMMARY REPORT: CERTIFICATE NUMBER 901125N1.11072 ALSYS LIMITED, ALSYCOMP-023, VERSION 5.3, IBM 370 3084Q (UNDER MVS/XA RELEASE 3.2)
15 Aug. 1990 115 p Sponsored by DOD
(AD-A236412; AVF-VSR-90502/77-910404) Avail: NTIS HC/MF A06 CSCL 12/5

This Validation Summary Report describes the extent to which a specific Ada compiler conforms to the Ada Standard, ANSI/MIL-STD-1815A. This report explains all technical terms used within it and thoroughly reports the results of testing this compiler using the Ada Compiler Validation Capability. An Ada compiler must be implemented according to the Ada Standard, and any implementation-dependent features must conform to the requirements of the Ada Standard. The Ada Standard must be implemented in its entirety, and nothing can be implemented that is not in the Standard. Even though all validated Ada compilers conform to the Ada Standard, it must be understood that some differences do exist between implementations. The Ada Standard permits some implementation dependencies - for example, the maximum length of identifiers or the maximum values of integer types. Other differences between compilers result from the characteristics of particular operating systems, hardware, or implementation strategies. All the dependencies observed during the process of testing this compiler are given in this report. The information in this report is derived from the test results produced during validation testing. The validation process includes submitting a suite of standardized tests, the ACVC, as inputs to an Ada compiler and evaluating the results. GRA

N91-27849# Information Systems and Technology Center, Wright-Patterson AFB, OH. Validation Ion Facility.
Ada COMPILER VALIDATION SUMMARY REPORT. CERTIFICATE NUMBER: 901128W1.11092, TELESOFT IBM Ada 370, VERSION 1.1.0 IBM 4391 (HOST) IBM 4381 (TARGET) Final Report
18 Apr. 1991 31 p Sponsored by DOD
(AD-A236416) Avail: NTIS HC/MF A03 CSCL 12/5

This Validation Summary Report describes the extent to which a specific Ada compiler conforms to the Ada Standard, ANSI/MIL-STD-1815A. All technical terms used are defined and the results are reported of testing this compiler using the Ada Compiler Validation Capability. An Ada compiler must be implemented according to the Ada Standard, and any implementation-dependent features must conform to the requirements of the Ada Standard. The Ada Standard must be implemented in its entirety, and nothing can be implemented that is not in the Standard. Even though all validated Ada compilers conform to the Ada Standard, it must be understood that some differences do exist between implementations. The Ada Standard permits some implementation dependencies; for example, the maximum length of identifiers or the maximum value of integer types. Other differences between compilers result from the characteristics of particular operating systems, hardware, or implementation strategies. All the dependencies observed during the process of testing this compiler are given. The information is derived from the test results produced during validation testing. The validation process includes submitting a suite of standardized tests, the ACVC, as inputs to an Ada compiler and evaluating the results. GRA

N91-27850# Information Systems and Technology Center, Wright-Patterson AFB, OH. Validat Ion Facility.
Ada COMPILER VALIDATION SUMMARY REPORT: CERTIFICATION NUMBER: 901003W1.11039, SOFTWARE LEVERAGE, INC. TOLERANT Ada DEVELOPMENT SYSTEM, VERSION 6.0, TOLERANT ETERNITY (HOST) TOLERANT ETERNITY (TARGET) Final Report
1 Apr. 1991 34 p Sponsored by DOD
(AD-A236417; AVF-VSR-400.0491) Avail: NTIS HC/MF A03 CSCL 12/5

This Validation Summary Report describes the extent to which a specific Ada compiler conforms to the Ada Standard, ANSI/MIL-STD-1815A. All technical terms used are defined and the results are reported of testing this compiler using the Ada Compiler Validation Capability. An Ada compiler must be implemented according to the Ada Standard, and any implementation-dependent features must conform to the requirements of the Ada Standard. The Ada Standard must be implemented in its entirety, and nothing can be implemented that is not in the Standard. Even though all validated Ada compilers conform to the Ada Standard, it must be understood that some differences do exist between implementations. The Ada Standard permits some implementation dependencies; for example, the maximum length of identifiers or the maximum values of integer types. Other differences between compilers result from the characteristics of particular operating systems, hardware, or implementation strategies. All the dependencies observed during the process of testing this compiler are given. The information is derived from the test results produced during validation testing. The validation process includes submitting a suite of standardized tests, the ACVC, as inputs to an Ada compiler and evaluating the results. GRA

N91-27851# Stanford Univ., CA. Systems Optimization Lab.
MONTE CARLO (IMPORTANCE) SAMPLING WITHIN A BENDERS DECOMPOSITION ALGORITHM FOR STOCHASTIC LINEAR PROGRAMS EXTENDED VERSION: INCLUDING RESULTS OF LARGE-SCALE PROBLEMS
Gerd Infanger Mar. 1991 42 p
(Contract N00014-89-J-1659)
(AD-A236419; SU-SOL-91-6) Avail: NTIS HC/MF A03 CSCL 12/4

Benders decomposition techniques and Monte Carlo sampling (importance sampling) are examined for use in solving two-stage stochastic linear programs with recourse, a method first introduced by George B. Dantzig and Peter Glynn (1990). The algorithm is discussed and further developed. A complete presentation is given of the method as it is currently implemented. Numerical results from test problems of different areas are presented. Using small test problems, the solution obtained by the algorithm are compared with the universe solutions. The solution is presented of large scale problems with numerous stochastic parameters which in the deterministic equivalent formulation would have billions of constraints. The problems concern expansion planning of electric utilities with uncertainty in the availabilities of generators and transmission lines and portfolio management with uncertainty in the future return. GRA

N91-27852# Naval Ocean Systems Center, San Diego, CA.
IMPLEMENTATION OF VQ ALGORITHMS ON A RECONFIGURABLE ARRAY PROCESSOR
Thomas B. Henderson and K. S. Thyagarajan May 1991 6 p
(AD-A236483) Avail: NTIS HC/MF A02 CSCL 12/5

Vector quantization is being widely used in image data compression applications due to the facts that it is capable of achieving fractional bit rates with reasonable complexity and that the decoding is a very simple table look-up scheme. In image encoding, a vector quantizer accepts a block of pixels and outputs an address of the best matching tile stored in a codebook. The matching algorithm requires a large number of basic arithmetic operations in typical applications. Since real time coding is required in many video applications, the need for dedicated processing

architectures arises naturally. The mapping is studied of VQ algorithms onto an array processor to achieve near real time compression of video images. GRA

N91-27853# Analytic Sciences Corp., Reading, MA.
EVALUATION AND VALIDATION GUIDEBOOK, VERSION 3.0 Interim Report
Peter G. Clark and Bard S. Crawford May 1991 238 p
(Contract F33615-85-C-1812)
(AD-A236494; TASC-TR-5234-4; WL-TR-91-1038) Avail: NTIS HC/MF A11 CSCL 12/5

The Ada community, including Government, industry, and academic personnel, needs the capability to assess APSEs (Ada Programming Support Environments) and their components, and to determine their conformance to applicable standards (e.g., MIL-STD-1838A, the CAIS standard). The technology required to fully satisfy this need is extensive and largely unavailable; it cannot be acquired by a single government-sponsored, professional society sponsored, or private effort. The purpose of the APSE Evaluation and Validation (E and V) Project is to provide a focal point for addressing the need by: (1) Identifying and defining specific technology requirements; (2) Developing selected elements of this technology; Encouraging others to develop additional elements; and (4) Collecting information describing elements which already exist. The purpose of the E and V Guidebook is to provide information that will help users to assess APSEs and APSE components. GRA

N91-27854# Naval Ocean Systems Center, San Diego, CA.
SUPERCONCURRENCY: A FORM OF DISTRIBUTED HETEROGENEOUS SUPERCOMPUTING
Richard F. Freund and D. S. Conwell May 1991 11 p
(AD-A236524) Avail: NTIS HC/MF A03 CSCL 12/5

Some of the complex issues of future supercomputing are discussed in the Richard Hill and John Gustafson papers published in the June 1990 issue of SUPERCOMPUTING REVIEW. Both papers contemplate the role of parallel processors in future operational environments. It is a variation of Gustafson's suggested approach, heterogeneous parallelism, that we will explore here, in particular Distributed Heterogeneous Supercomputing (DHS). DHS is the use of a heterogeneous suite of diverse processors, e.g., a mix of vector and parallel computers. DHS is not simply a LAN or a WAN because it aims to exploit the heterogeneous nature of the suite for reasons such as access to different data bases, access to remote special processors, or super-speed performance. Performance is the key to the Superconcurrency (Super-C) form of DHS, because Super-C tunes the selections of the different processors and optimally distributes the work primarily for maximum performance on the problem at hand (and only secondarily for load balancing). GRA

N91-27855# SRI International Corp., Menlo Park, CA. Computer Science Lab.
THE PEGASYS ENVIRONMENT FOR GRAPHICAL DOCUMENTATION OF LARGE PROGRAMS Final Report
Mark Moriconi 18 May 1991 61 p
(Contract N00014-86-C-0075)
(AD-A236557) Avail: NTIS HC/MF A04 CSCL 12/5

This final report describes the PegaSys languages, methodology, and techniques for specifying and reasoning about system structures. PegaSys supports both visual and textual specification, where pictures are intuitive representations of logical assertions written in the textual language. To mitigate the problems of scale, the PegaSys methodology supports both horizontal and vertical hierarchies and provides for user-defined abstractions in specifications. Since PegaSys is based on logic, it can reason about designs and programs. For example, it can prove (automatically) that a structural design hierarchy is correct and find (automatically) a conservative approximation of the semantic effects of changes to programs. These advances will allow the PegaSys environment to be considerably more powerful than the CASE tools currently used in industry to develop large software systems. The first part of this report presents a scenario that illustrates the basic ideas behind the PegaSys languages and methodology. The underlying logic is a decidable subset of Ehdm, a state of the art formal specification language developed in the Computer Science Laboratory. The second part of the report presents the details of our technique for deducing the effects of changes to a program (changes to a design are not handled). The new material presented in this report is not implemented in PegaSys at this time. GRA

N91-27856# Boeing Military Airplane Development, Wichita, KS.
Ada COMPILER EVALUATION CAPABILITY: VERSION DESCRIPTION DOCUMENT, RELEASE 2.0 Interim Report
Thomas Leavitt and Kermit Terrell May 1991 287 p
(Contract F33615-86-C-1050)
(AD-A236684; WL-TR-91-1039) Avail: NTIS HC/MF A13 CSCL 12/5

This Validation Summary Report describes the extent to which a specific Ada compiler conforms to the Ada Standard, ANSI/MIL-STD-1815A. This report explains all technical terms used within it and thoroughly reports the results fo testing this compiler using the Ada compiler Validation Capability. An Ada compiler must be implemented according to the Ada Standard, and any implementation-dependent features must conform to the requirements of the Ada Standard must be implemented in its entirety, and nothing can be implemented that is not in the Standard. Even though all validated Ada compilers conform to the Ada Standard, it must be understood that some differences do exist between implementations. The Ada Standard permits some implementation dependencies - for example, the maximum length of identifiers or the maximum values of integer types. Other differences between compilers results from the characteristics of particular operating systems, hardware, or implementation strategies. All the dependencies observed during the process of testing this compiler are given in this report. The information in this report is derived from the test results produced during validation testing. The validation process includes submitting a suite of standardized tests, the ACVC, as inputs to an Ada compiler and evaluating the results. GRA

N91-27857# Naval Postgraduate School, Monterey, CA.
COMPARISON OF SLOTLINE CHARACTERISTICS M.S. Thesis
Yong S. Seo Jun. 1990 53 p
(AD-A236685) Avail: NTIS HC/MF A04 CSCL 09/1

The slot width required for conventional slotlines is very narrow when etched on low dielectric constant substrates. This poses fabrication difficulties and discourages the use of slotlines on these substrates. However, the slotline is finding increased applications in slot antennas. In order to feed the slot antennas, alternate structures must be found that relax the fabricational difficulties. Two such new structures are the bilateral slotline and the asymmetric slotline. In this thesis, design data was developed and comparison was made between the various slotlines with regards to the substrate parameters and the slot width. Use was made of computer codes already developed for these structures. GRA

N91-27858# North Carolina Univ., Chapel Hill. Dept. of Computer Science.
SUPERCOMPUTING POWER FOR INTERACTIVE VISUALIZATION Progress Report, Oct. 1990 - Mar. 1991
Henry Fuchs, John Poulton, John Eyles, Laura Weaver, and Mike Bajura Mar. 1991 18 p
(Contract N00014-86-K-0680; NSF MIP-90-00894)
(AD-A236717) Avail: NTIS HC/MF A03 CSCL 12/6

Multicomputer architectures have been explored for 3-D graphics that offer the promise of scalability, very high performance, and greater flexibility and range of application than today's systems. While current high performance commercial graphics systems employ various forms of parallelism to support interaction with 3-D objects and scenes, all operate on a single stream of graphics primitives. Much effort was devoted to finding ways to operate in parallel both on lists of graphics primitives as well as on the

pixels within primitives, and to incorporate parallel execution of user application code to generate and modify the graphics primitives to be displayed. GRA

N91-27859# RAND Corp., Santa Monica, CA.
AN ANALYST'S PRIMER FOR THE RAND/ABEL TRADEMARK PROGRAMMING LANGUAGE Interim Report
Paul K. Davis May 1990 52 p
(Contract MDA903-90-C-0004)
(AD-A236776; RAND/N-3042-NA) Avail: NTIS HC/MF A04
CSCL 12/5

This is a primer for analysts wishing to use the RAND-ABEL programming language, a fast high level strongly typed procedural language developed for use in building large and complex knowledge based simulations in a C/UNIX environment. The primer supplements the comprehensive reference manual by providing a simple introduction and problem sets. The targeted reader is an analyst with subject-area knowledge, modeling capability, and a general understanding of computer programming-but only modest programming skills. After reading this primer and working through the exercises provided, such a person should be able to read and modify substantive logic within RAND-ABEL programs, although sometimes going to the reference manual and depending on more proficient programmers for complex operations or subtle debugging. GRA

N91-27860# Weapons Systems Research Lab., Adelaide (Australia).
TURBO PASCAL/GEM SOFTWARE INTERFACE FOR SCIENTIFIC GRAPH PREPARATION
R. M. Thamm, D. A. Green, and O. M. Williams Apr. 1991 51 p
(AD-A236825; WSRL-GD-02/91; DODA-AR-006-485) Avail: NTIS HC/MF A04 CSCL 12/5

This document represents a user manual for the Turbo Pascal/GEM software interface that has been developed recently within Guided Weapons Division. The interface has been developed primarily to enable Turbo Pascal programmer to replicate their softcopy graphical output in high quality hardcopy form. The output from the interface is a GEM file that can be edited as required within either GEM Draw or GEM Artline, prior to generation of a PostScript file. A number of mathematical procedures have been included in order to extend the capabilities of Turbo Pascal, together with a useful library of curve fitting procedures. The interface also incorporates a form filling technique for versatile data entry at any point within a Turbo Pascal program. A detailed description of all procedures and functions is included together with the code and graphical output from a number of test programs designed to illustrate the capabilities of the interface. GRA

N91-27861# Aeronautical Research Labs., Melbourne (Australia).
A FORTRAN PROGRAM FOR SPECTRAL ANALYSIS USING THE FAST FOURIER TRANSFORM
L. D. MacLaren and S. D. Hill Mar. 1991 28 p
(AD-A236848; ARL-Flight-Mech-TM-432; DODA-AR-006-583)
Avail: NTIS HC/MF A03 CSCL 12/5

The analysis of random data is frequently carried out on-line using a hardware based Fourier analyzer. Capabilities similar to those provided in the on line analyzers have been developed in a FORTRAN computer program that can be used to analyze a digital time dependent signal at the post test stage. An overview of the calculation methods used within this software is also presented. GRA

N91-27862*# National Aeronautics and Space Administration. John C. Stennis Space Center, Bay Saint Louis, MS.
A SUPERIOR EDGE PRESERVING FILTER WITH A SYSTEMATIC ANALYSIS
Kenneth W. Holladay (New Orleans Univ., LA.) and Doug Rickman Washington Aug. 1991 41 p
(NASA-TM-4311; NAS 1.15:4311) Avail: NTIS HC/MF A03
CSCL 09B

A new, adaptive, edge preserving filter for use in image processing is presented. It had superior performance when compared to other filters. Termed the contiguous K-average, it aggregates pixels by examining all pixels contiguous to an existing cluster and adding the pixel closest to the mean of the existing cluster. The process is iterated until K pixels were accumulated. Rather than simply compare the visual results of processing with this operator to other filters, some approaches were developed which allow quantitative evaluation of how well and filter performs. Particular attention is given to the standard deviation of noise within a feature and the stability of imagery under iterative processing. Demonstrations illustrate the performance of several filters to discriminate against noise and retain edges, the effect of filtering as a preprocessing step, and the utility of the contiguous K-average filter when used with remote sensing data. Author

N91-27863*# Xerox Corp., Palo Alto, CA.
OPTIMAL EXPRESSION EVALUATION FOR DATA PARALLEL ARCHITECTURES
J. R. Gilbert and R. Schreiber (National Aeronautics and Space Administration. Ames Research Center, Moffett Field, CA.) Nov. 1990 20 p
(NASA-CR-188681; NAS 1.26:188681; PB91-176495; CSL-90-9)
Copyright Avail: NTIS HC/MF A03 CSCL 09B

A data parallel machine represents an array or other composite data structure by allocating one processor per data item. A pointwise operation can be performed between two such arrays in unit time, provided their corresponding elements are allocated in the same processors. If the arrays are not aligned in this fashion, the cost of moving one or both of them is part of the cost of operation. The choice of where to perform the operation then affects this cost. If an expression with several operands is to be evaluated, there may be many choices of where to perform the intermediate operations. An efficient algorithm is given to find the minimum cost way to evaluate an expression, for several different data parallel architectures. The algorithm applies to any architecture in which the metric describing the cost of moving an array has a property called robustness. This encompasses most of the common data parallel communication architectures, including meshes of arbitrary dimension and hypercubes. Author

N91-27864# National Inst. of Standards and Technology, Gaithersburg, MD. Software Standards Validation Group.
PROGRAMMING LANGUAGES AND DATABASE LANGUAGE SQL. VALIDATED PROCESSOR LIST INCLUDING GOSIP CONFORMANCE TESTING REGISTERS
J. B. Kailey Apr. 1991 59 p
(PB91-187716; NISTIR-4557) Avail: NTIS HC/MF A04 CSCL 09B

The Validated Processor List identifies those COBOL, FORTRAN, Ada, and Pascal programming language processors that have a current validation certificate and those Structured Query Language processors that have a registered test report, referencing the applicable Federal Information Processing Standard (FIPS) as of the date of the publication. The testing of language processors to determine the degree to which they conform to the Federal Standards is required by Government agencies as specified by the FIPS, Federal Information Resources Management Regulation (FIRMR) Parts 201.13 and 201.39, and the associated Federal ADP and Telecommunications Standards Index. Author

N91-27865# National Inst. of Standards and Technology, Gaithersburg, MD. Applied and Computational Mathematics Div.
INTERIOR-POINT METHOD FOR LINEAR AND QUADRATIC PROGRAMMING PROBLEMS
P. T. Boggs, P. D. Domich, J. E. Rogers, and C. Witzgall Apr. 1991 13 p
(PB91-187815; NISTIR-4556) Avail: NTIS HC/MF A03 CSCL 09B

A particular class of interior point methods for solving linear programming problems has been studied for several years. The method combines several search directions that are readily computed at each iteration. The final step is then calculated by

computing the step that solves the original problem restricted to the subspace spanned by these several directions. An extension is proposed of these ideas to the case of convex quadratic programming. Author

N91-27866# National Center for Atmospheric Research, Boulder, CO.
MULTIGRID SOFTWARE FOR ELLIPTIC PARTIAL DIFFERENTIAL EQUATIONS: MUDPACK
J. C. Adams Feb. 1991 59 p
(PB91-168088; NCAR/TN-357+STR) Avail: NTIS HC/MF A04 CSCL 09B

Described here is the multigrid package MUDPACK, which includes FORTRAN routines for efficiently approximating the solution to a variety of linear elliptic partial differential equations. The purpose is to make the complex collection of integrated numerical procedures known as multigrid iteration available in a user friendly form to atmospheric scientists and others. Author

N91-28075*# Spelman Coll., Atlanta, GA. Dept. of Mathematics.
IMPLEMENTATION OF AN ALGORITHM FOR CYLINDRICAL OBJECT IDENTIFICATION USING RANGE DATA
Sylvia T. Bozeman and Benjamin J. Martin *In* Alabama A & M Univ., NASA-HBCU Space Science and Engineering Research Forum Proceedings 1989 p 61-68 (For primary document see N91-28063 19-99)
Avail: NTIS HC/MF A23 CSCL 09B

62 COMPUTER SYSTEMS

Includes computer networks and special application computer systems.

N91-27867# Argonne National Lab., IL.
ON THE PARALLELIZATION OF AN ADAPTIVE MULTIGRID ALGORITHM FOR A CLASS OF FLOW PROBLEMS
C. P. Thompson (Bergen Scientific Centre, Norway), W. R. Cowell, and G. K. Leaf 1991 19 p Presented at the 5th Copper Mountain Conference on Multigrid Methods and Multigrid Short Course, Copper Mountain, 31 Mar. - 5 Apr. 1991
(Contract W-31-109-eng-38)
(DE91-010795; ANL/CP-72220; CONF-9103161-1) Avail: NTIS HC/MF A03

The parallelization is described of an adaptive multigrid code that solves the steady, laminar, incompressible Navier-Stokes equations. Parallelism was achieved as loop concurrency on a shared memory multiprocessor. Analysis of the code for parallelism, in particular the location of data dependencies that inhibit parallelism, was aided by the use of the software tool VecPar-77. They propose a model of loop-based parallel computation that enables them to define the relationship among the notions of speed-up, extent of parallelization, and problem size. They present speedup results obtained on a Sequent Symmetry and use the model to interpret them. DOE

N91-27868*# SRI International Corp., Menlo Park, CA.
FORMAL SPECIFICATION AND VERIFICATION OF A FAULT-MASKING AND TRANSIENT-RECOVERY MODEL FOR DIGITAL FLIGHT-CONTROL SYSTEMS Final Report
John Rushby Washington Jul. 1991 129 p
(Contract NAS1-18969)
(NASA-CR-4384; NAS 1.26:4384) Avail: NTIS HC/MF A07 CSCL 09B

The formal specification and mechanically checked verification for a model of fault-masking and transient-recovery among the replicated computers of digital flight-control systems are presented. The verification establishes, subject to certain carefully stated assumptions, that faults among the component computers are masked so that commands sent to the actuators are the same as those that would be sent by a single computer that suffers no failures. Author

N91-27869*# Institute for Computer Applications in Science and Engineering, Hampton, VA.
PERFORMANCE AND FAULT-TOLERANCE OF NEURAL NETWORKS FOR OPTIMIZATION Final Report
Peter W. Protzel, Daniel L. Palumbo, and Michael K. Arras Jun. 1991 34 p Submitted for publication
(Contract NAS1-18605)
(NASA-CR-187582; NAS 1.26:187582; ICASE-IR-91-45) Avail: NTIS HC/MF A03 CSCL 09B

One of the key benefits of future hardware implementations of certain Artificial Neural Networks (ANNs) is their apparently built-in fault-tolerance, which makes them potential candidates for critical tasks within high reliability requirements. The fault-tolerance characteristics of time-continuous, recurrent ANNs that can be used to solve optimization problems are discussed. The performance of these networks is first illustrated by using well-known model problems like the Traveling Salesman Problem and the Assignment Problem. The ANNs are then subjected to up to 13 simulations stuck-at-1 or stuck-at-0 faults for network sizes of up to 900 neurons. The effect of these faults on the performance is demonstrated and the cause for the observed fault-tolerance is discussed. An application is presented in which a network performs a critical task for a real-time distributed processing system by generating new task allocations during the reconfiguration of the system. The performance degradation of the ANN under the presence of faults is investigated by largescale simulations and the potential benefits of delegating a critical task to a fault-tolerant network are discussed. Author

N91-27870# Massachusetts Inst. of Tech., Cambridge. Artificial Intelligence Lab.
EXPERIMENTS WITH DATAFLOW ON A GENERAL-PURPOSE PARALLEL COMPUTER
Ellen Spertus and William J. Dally Jan. 1991 21 p
(Contracts N00014-85-K-0124; N00014-88-K-0738; N00014-87-K-0825; MIP-8657531)
(AD-A235521; AI-M-1272) Avail: NTIS HC/MF A03 CSCL 12/6

The MIT J-Machine, a massively-parallel computer, is an experiment in providing general-purpose mechanisms for communication, synchronization, and naming that will support a wide variety of parallel models of computation. Having universal mechanisms allows the separation of issues of language design and machine organization. Two experimental dataflow programming systems were developed for the J-Machine. For the first system, the Papadopoulos explicit token store was adapted to implement static and then dynamic dataflow. Each node in a dataflow graph is expanded into a sequence of code, each of which is scheduled individually at runtime. For a later system, use was made of the Iannucci hybrid execution model to combine several dataflow graph nodes into a single sequence, decreasing scheduling overhead. By combining the strengths of the two systems, it is possible to produce a system with competitive performance. The feasibility of efficiently executing dataflow programs was demonstrated on a general purpose parallel computer. GRA

N91-27871# Rochester Univ., NY. Dept. of Computer Science.
IMAGE UNDERSTANDING AND INTELLIGENT PARALLEL SYSTEMS Final Report, 1 Dec. 1988 - 30 Sep. 1990
Christopher M. Brown 9 May 1991 75 p
(Grant AF-AFOSR-0222-89; AF Proj. 7707)
(AD-A236229; AFOSR-91-0528TR) Avail: NTIS HC/MF A04 CSCL 12/6

Papers, ideas, algorithms, analysis, software, applications, and implementations were developed and disseminated for parallel vision applications and programming environments for parallel computer vision. Parallels vision and the related programming environment were extensively examined. GRA

N91-27872# Naval Postgraduate School, Monterey, CA.
LOCAL AREA NETWORKING HANDBOOK M.S. Thesis
Patricia A. OHara Jun. 1990 92 p
(AD-A236835) Avail: NTIS HC/MF A05 CSCL 25/5

This thesis provides Navy shore based commands with sufficient information on local area networking to: (1) decide if they need a LAN; (2) determine what their networking requirements are; and (3) select a LAN that satisfies their requirements. The LAN topologies, transmission media, and medium access methods are described. In addition, the OSI reference model for computer networking and the IEEE 802 LAN standards are explained in detail. A method for conducting a LAN requirements assessment is discussed, followed by a strategy for selecting a local area network. GRA

N91-27873*# SRI International Corp., Menlo Park, CA.
MECHANICAL VERIFICATION OF A SCHEMATIC BYZANTINE CLOCK SYNCHRONIZATION ALGORITHM Final Report
Natarajan Shankar Washington NASA Jul. 1991 133 p
(Contract NAS1-18226)
(NASA-CR-4386; NAS 1.26:4386; SRI-7398) Avail: NTIS HC/MF A07 CSCL 09B

Schneider generalizes a number of protocols for Byzantine fault tolerant clock synchronization and presents a uniform proof for their correctness. The authors present a machine checked proof of this schematic protocol that revises some of the details in Schneider's original analysis. The verification was carried out with the EHDM system developed at the SRI Computer Science Laboratory. The mechanically checked proofs include the verification that the egocentric mean function used in Lamport and Melliar-Smith's Interactive Convergence Algorithm satisfies the requirements of Schneider's protocol. Author

N91-27874*# Computer Sciences Corp., Moffett Field, CA.
A SURVEY OF PARALLEL PROGRAMMING TOOLS
Doreen Y. Cheng May 1991 71 p
(Contract NAS2-12961)
(NASA-CR-188680; NAS 1.26:188680; RND-91-005) Avail: NTIS HC/MF A04 CSCL 09B

This survey examines 39 parallel programming tools. Focus is placed on those tool capabilites needed for parallel scientific programming rather than for general computer science. The tools are classified with current and future needs of Numerical Aerodynamic Simulator (NAS) in mind: existing and anticipated NAS supercomputers and workstations; operating systems; programming languages; and applications. They are divided into four categories: suggested acquisitions, tools already brought in; tools worth tracking; and tools eliminated from further consideration at this time. Author

63 CYBERNETICS

Includes feedback and control theory, artificial intelligence, robotics and expert systems.

For related information see also *54 Man/System Technology and Life Support.*

N91-27875 Clarkson Univ., Potsdam, NY.
ADAPTIVE CONTROL OF PNEUMATIC ACTUATION SYSTEMS Ph.D. Thesis
Jing Tang 1990 237 p
Avail: Univ. Microfilms Order No. DA9107069

Pneumatic actuators are highly nonlinear as a result of high Coulomb friction, transmission delays, and compressibility effects. In an effort to overcome nonlinearities, two types of adaptive control schemes have been employed to control the position of a pneumatic actuator. These two schemes are variables structure control (VSC), and self tuning control (STC). A model of a pneumatic actuator was developed to allow these control systems to be studied via simulations. Results from the simulation indicate that the VSC technique can position the actuator rapidly, via a first order trajectory, in response to a step input. However, large static friction forces cause the system to oscillate vigorously about the desired trajectory. STC simulation results indicated that a linear identification scheme can be used in conjunction with a minimum variance controller to control the position of an actuator. To achieve accurate positioning, it was necessary to repeat the positioning operation several times. An experimental study of these two systems verified the simulation work, and demonstrated the need for short air transmission lines to minimize uncontrollable oscillatory behavior. A dead zone, existing at the beginning of the actuators' travel, was found to be a function of the relatively large static friction forces. It was shown that the actuator could be placed with +/-5 mm of the desired position in the case of the VSC, and +/-6 mm in the case of STC. Dissert. Abstr.

N91-27876*# North Carolina Agricultural and Technical State Univ., Greensboro. Dept. of Industrial Engineering.
AN EXPERT SYSTEM FOR PLANNING AND SCHEDULING IN A TELEROBOTIC ENVIRONMENT Final Report, 18 May 1987 - 28 Feb. 1991
Celestine A. Ntuen and Eui H. Park Jun. 1991 121 p
(Grant NAG1-763)
(NASA-CR-188648; NAS 1.26:188648) Avail: NTIS HC/MF A06 CSCL 09B

A knowledge based approach to assigning tasks to multi-agents working cooperatively in jobs that require a telerobot in the loop was developed. The generality of the approach allows for such a concept to be applied in a nonteleoperational domain. The planning architecture known as the task oriented planner (TOP) uses the principle of flow mechanism and the concept of planning by deliberation to preserve and use knowledge about a particular task. The TOP is an open ended architecture developed with a NEXPERT expert system shell and its knowledge organization allows for indirect consultation at various levels of task abstraction. Considering that a telerobot operates in a hostile and nonstructured environment, task scheduling should respond to environmental changes. A general heuristic was developed for scheduling jobs with the TOP system. The technique is not to optimize a given scheduling criterion as in classical job and/or flow shop problems. For a teleoperation job schedule, criteria are situation dependent. A criterion selection is fuzzily embedded in the task-skill matrix computation. However, goal achievement with minimum expected risk to the human operator is emphasized. Author

N91-27877*# Washington Univ., Seattle. Dept. of Mechanical Engineering.
PROGRESS IN MULTIRATE DIGITAL CONTROL SYSTEM DESIGN Final Report
Martin C. Berg and Gregory S. Mason Jun. 1991 102 p
(Grant NAG1-1055)
(NASA-CR-187561; NAS 1.26:187561) Avail: NTIS HC/MF A06 CSCL 09B

A new methodology for multirate sampled-data control design based on a new generalized control law structure, two new parameter-optimization-based control law synthesis methods, and a new singular-value-based robustness analysis method are described. The control law structure can represent multirate sampled-data control laws of arbitrary structure and dynamic order, with arbitrarily prescribed sampling rates for all sensors and update rates for all processor states and actuators. The two control law synthesis methods employ numerical optimization to determine values for the control law parameters. The robustness analysis method is based on the multivariable Nyquist criterion applied to the loop transfer function for the sampling period equal to the period of repetition of the system's complete sampling/update schedule. The complete methodology is demonstrated by application to the design of a combination yaw damper and modal suppression system for a commercial aircraft. Author

N91-27878# Connecticut Univ., Storrs. Dept. of Electrical and Systems Engineering.
STOCHASTIC ADAPTIVE CONTROL AND ESTIMATION ENHANCEMENT Final Report, 1 Aug. 1988 - 30 Jun. 1990
Y. Bar-Shalom Feb. 1991 7 p
(Grant AF-AFOSR-0202-88; AF Proj. 2304)
(AD-A235513; AFOSR-91-0394TR) Avail: NTIS HC/MF A02 CSCL 12/3

The investigations summarized deal with (1) adaptive dual

control systems with unknown parameters, (2) estimation and control of hybrid stochastic systems, (3) distributed estimation in systems with measurements of uncertain origin, (4) solution of continuous-time hybrid stochastic differential equations, and (5) use of point process theory for target mode estimation. GRA

N91-27879# Maryland Univ., College Park. Dept. of Physics.
CONNECTIONIST MODELS FOR INTELLIGENT COMPUTATION Final Report, 1 Sep. 1987 - 30 Sep. 1990
H. H. Chen and Y. C. Lee 30 Sep. 1990 4 p
(Grant AF-AFOSR-0388-87; AF Proj. 2305)
(AD-A235514; AFOSR-91-0393TR) Avail: NTIS HC/MF A01 CSCL 12/9

Some areas of discussion are as follows: Neural Networks with High Order Connections; Learning Stereopsis with Neural Networks, Efficient Learning Algorithm for Neural Networks; Parallel Sequential Induction Network; and Higher Order Recurrent Networks and Grammatical Inference. GRA

N91-27880# Brown Univ., Providence, RI. Center for Neural Science.
FEATURE EXTRACTION USING AN UNSUPERVISED NEURAL NETWORK
Nathan Intrator 3 May 1991 10 p
(Contract N00014-86-K-0041)
(AD-A235581; TR-56) Avail: NTIS HC/MF A02 CSCL 12/9

A novel unsupervised neural network for dimensionality reduction which seeks directions emphasizing distinguishing features in the data is presented. A statistical framework for the parameter estimation problem associated with this neural network is given and its connection to exploratory projection pursuit methods is established. The network is shown to minimize a loss function (projection index) over a set of parameters, yielding an optimal decision rule under some norm. A specific projection index that favors directions possessing multimodality is presented. This leads to a similar form to the synaptic modification equations governing learning in Bienenstock, Cooper, and Munro (BCM) neurons (1982). The importance of a dimensionality reduction principle based solely on distinguishing features, is demonstrated using a linguistically motivated phoneme recognition experiment, and compared with feature extraction using principal components and back propagation network. GRA

N91-27881# Orincon Corp., La Jolla, CA.
EVOLUTIONARY PROGRAMMING FOR AUTOMATIC CONTROL Final Report
30 Apr. 1991 59 p
(Contract N00014-90-C-0109)
(AD-A235875; OCR-91-U-0162) Avail: NTIS HC/MF A04 CSCL 12/9

Modern control theory has scored impressive gains in the comparatively few years of its existence. This includes conventional optimal control, as well as many forms of adaptive control, pole-placement using state-variable feedback, control of multi-input/multi-output systems by entire Eigen structure assignment, and the Kalman filter. As powerful as the theory has become, it still has limitations. These are felt when one deals with time varying systems such as moving robot arms with their variable moment of inertia. Nonlinear systems can also pose significant difficulties for the present theory. Systems designed by optimal control theory are not always robust with respect to parameter variations or changes in the form of the input relative to that of the original design. It can be difficult to translate performance requirements into the weighting matrices of the cost function that must be minimized in the optimal control formalism. There is currently interest in the identification and control of stochastic systems where the mathematical model of the system is unknown, or where only partial information is available. Such problems are typical of the real world, where most physical systems are perturbed by unwanted external disturbances and accurate mathematical models for present-day complex systems are rarely attainable. Many control problems are not easily transformed into the usual required formalisms. Evolutionary programming, an artificial intelligence technique, offers a new approach to the general problem of automatic control. GRA

N91-27882# Army Armament Research, Development and Engineering Center, Picatinny Arsenal, NJ. Fire Support Armaments Center.
NEURAL NETWORKS: AN OVERVIEW
Thomas Brady May 1991 45 p
(AD-A236270; ARFSD-TR-91005) Avail: NTIS HC/MF A03 CSCL 12/9

This report provides an introduction to the field of neural networks, what they are, how they came about, how they work, how they are used, and their current status and potentialities. Neurons are brain cells. There are approximately ten billion (10(exp 10)) brain cells of varying types in the human brain. These are interconnected by axons and dendrites, the axon being the output fiber of a neuron which branches off into dendrites which in turn connect to other neurons. The interconnectivity can be quite dense with one neuron receiving inputs from up to thousands of others. The action of the neuron is to generate an electrical pulse or pulse train if the summation of its inputs exceeds a threshold associated with a particular neuron. The collection is thus similar to a vast highly interconnected network of threshold elements. It is this network which constitutes the human thinking machine. This thinking machine has capabilities that, to date, have frustrated duplication by large scale digital computers. These capabilities are not in the area of esoteric high level mathematics but in what are generally considered simple normal processes, that is processes that could be performed even by children. GRA

N91-27883# Stanford Univ., CA. Dept. of Electrical Engineering.
FIRST-ORDER GRADIENT DESCENT TRAINING OF ADAPTIVE DISCRETE-TIME DYNAMIC NETWORKS Final Report, Apr. 1989 - Sep. 1990
Stephen W. Piche and Bernard Widrow May 1991 35 p
(Contract F30602-88-D-0025)
(AD-A236796; RL-TR-91-62) Avail: NTIS HC/MF A03 CSCL 23/2

The training of discrete-time dynamic systems with adaptive parameters (recurrent neural networks) using first-order gradient descent algorithms is described. To facilitate the explanation of these algorithms, a standard representation of a discrete-time dynamic system is defined. Any differentiable discrete dynamic system may be put in this standard representation and trained using a gradient descent algorithm. Using the standard representation, two general types of learning algorithms are described. The first is based upon the discrete-time Euler-Lagrange equations, and the second is based upon a recursive update of the output gradients. Both the epochwise and on-line versions of these algorithms are presented. When the dynamic system is implemented by a neural network, the epochwise algorithm based on the Euler-Lagrange equations is equivalent to back-propagation-through-time and the on-line method based on the recursive equation is the same as recursive backpropagation. It is shown that the epochwise versions of the algorithms are equivalent. The two on-line versions of the algorithms are shown to be approximately equivalent. GRA

N91-27884# Search Technology, Inc., Norcross, GA.
ADAPTIVE AIDING FOR HUMAN-COMPUTER CONTROL: FUTURE DIRECTIONS FOR RESEARCH Final Report, 15 Dec. 1986 - 6 Dec. 1989
Robert C. Andes, Jr. and Ruston M. Hunt Oct. 1990 35 p
(Contract F33615-86-C-0545)
(AD-A236799; STI-TR-8704-001; AAMRL-TR-90-055) Avail: NTIS HC/MF A03 CSCL 23/2

The recent history of the project is presented in summary form, with references to previous reports. The most recent simulation environment, RESCUE, developed for the study of human performance within an adaptively aided task environment, is reviewed with particular emphasis placed on the current

implementation of RESCUE. Additionally, code enhancements of the RESCUE environment designed to increase system reliability are reviewed. The largest segment of the report discusses the fundamental adaptive aiding issues followed by unresolved research questions pertaining to the use of this form of aiding within complex task environments. Specific issues involved with the utilization of adaptive aiding technology within the DARPA Pilot's Associate Program are identified and discussed. Finally, a possible mapping of unresolved research issues in adaptive aiding to the simulation environment discussed in this document is proposed. GRA

64 NUMERICAL ANALYSIS

Includes iteration, difference equations, and numerical approximation.

N91-27885# Lawrence Livermore National Lab., CA.
TEXTURE SEGMENTATION BY CLUSTERING OF GABOR FEATURE VECTORS
Shin-Yee Lu, J. E. Hernandez, and G. A. Clark Jan. 1991 8 p Presented at the 1991 International Joint Conference on Neural Networks (IJCNN), Seattle, 8-12 Jul. 1991
(Contract W-7405-eng-48)
(DE91-008061; UCRL-JC-106451; CONF-910779-4) Avail: NTIS HC/MF A02

The texture segmentation problem was approached by clustering feature vectors created from a Gabor transform data block. Given an N x N image, 24 Gabor transforms were computed using Gabor kernels with six orientations and four sizes. This results in a Gabor data block composed of N(sup 2) feature vectors of length 24. Each feature vector contains frequency and orientation information characteristic of its corresponding pixel in the image. In order to choose the most important feature vectors and reduce the computational complexity of the problem, a clustering algorithm was used (a variation of Kohonen's Feature Map algorithm) to group the vectors based on their distribution in feature space. It was hypothesized that the pixels in a given group have similar characteristics, so that the technique can be used for texture segmentation. By clustering Gabor features, an image was segmented into regions of uniform texture without prior knowledge of the types of texture, or the frequency and orientation characteristics of these features. Texture segmentation algorithms that take the statistical approach and the structural approach require that the image be divided into fixed-size tiles and assume constant texture within each tile. The approach avoids this requirement. A time complexity analysis shows that using the Kohonen algorithm for clustering is faster that the nearest neighbor algorithm and the minimum spanning tree algorithm. The Kohonen algorithm is also more stable than the k-means algorithm, as it is insensitive to the initial assignment of cluster centers. Experiments were described using both simulated and measured image, in which the resulting clusters correspond to meaningful objects or regions in the image. DOE

N91-27886*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, OH.
FROM DIFFERENTIAL TO DIFFERENCE EQUATIONS FOR FIRST ORDER ODEs
Alan D. Freed and Kevin P. Walker (Engineering Science Software, Inc., Smithfield, RI.) Jul. 1991 6 p
(NASA-TM-104530; E-6406; NAS 1.15:104530) Avail: NTIS HC/MF A02 CSCL 12A

When constructing an algorithm for the numerical integration of a differential equation, one should first convert the known ordinary differential equation (ODE) into an ordinary difference equation. Given this difference equation, one can develop an appropriate numerical algorithm. This technical note describes the derivation of two such ordinary difference equations applicable to a first order ODE. The implicit ordinary difference equation has the same asymptotic expansion as the ODE itself, whereas the explicit ordinary difference equation has an asymptotic that is similar in structure but different in value when compared with that of the ODE. Author

N91-27887*# Institute for Computer Applications in Science and Engineering, Hampton, VA.
HOMOGENIZATION TECHNIQUES AND ESTIMATION OF MATERIAL PARAMETERS IN DISTRIBUTED STRUCTURES Final Report
H. T. Banks, D. Cioranescu, A. Das, R. Miller, and D. A. Rebnord (Syracuse Univ., NY.) Jun. 1991 24 p Submitted for publication
(Contract NAS1-18605; NAG1-1116; AF-AFOSR-0091-90; NSF DMS-88-18530)
(NASA-CR-187585; NAS 1.26:187585; ICASE-91-48) Avail: NTIS HC/MF A03 CSCL 12A

The use of homogenization techniques to derive approximate models with simple geometry is discussed for the physical models of grids and trusses which have a complex geometry that gives rise to computational difficulties. The presentation is in the context of inverse or parameter estimation problem for composite material structures with unknown characteristics such as stiffness, and internal damping. The necessary theoretical foundations are presented for this approach and comparison of modal properties of the resulting homogenization model is discussed for a two-dimensional grid structure with modal properties observed in experiments with this grid. Author

N91-27888*# Institute for Computer Applications in Science and Engineering, Hampton, VA.
EXPONENTIALLY STABLE APPROXIMATIONS OF WEAKLY DAMPED WAVE EQUATIONS Final Report
H. T. Banks, K. Ito, and C. Wang (University of Southern California, Los Angeles.) Jun. 1991 41 p Submitted for publication
(Contract NAS1-18605; NAG1-1116; AF-AFOSR-0091-90; NSF DMS-88-18530)
(NASA-CR-187584; NAS 1.26:187584; ICASE-IR-91-47) Avail: NTIS HC/MF A03 CSCL 12A

Wave equations with damping in the boundary conditions are considered. Techniques to ascertain the uniform preservation under approximation of exponential stability are presented. Several schemes for which preservation can be guaranteed are analyzed. Numerical results that demonstrate the lack of stability under approximation for several popular schemes (including standard finite difference and finite element schemes) are given. Author

N91-27889# Naval Postgraduate School, Monterey, CA. Dept. of Mathematics.
SOFTWARE FOR THE PARALLEL SOLUTION OF SYSTEMS OF ORDINARY DIFFERENTIAL EQUATIONS Technical Report, 2 Jan. - 25 Feb. 1991
Levi Lustman and Beny Neta Feb. 1991 30 p
(AD-A235489; NPS-MA-91-009) Avail: NTIS HC/MF A03 CSCL 12/5

In this report we supply software for the numerical solution of systems of ordinary differential equations (ODEs) on an INTEL iPSC/2 hypercube. The first program can only be used to solve linear initial or boundary value systems of ODEs and based on an algorithm developed by Katti and Neta (1989) and improved by Lustman et al., (1990). The second program is based on polynomial extrapolation and Gragg's scheme and is useful for nonlinear ODEs as well. This algorithm is described in Lustman, Neta and Gragg (1991). GRA

N91-27890# Massachusetts Inst. of Tech., Cambridge. Artifical Intelligence Lab.
ESTIMATION OF DISCONTINUOUS DISPLACEMENT VECTOR FIELDS WITH THE MINIMUM DESCRIPTION LENGTH CRITERION
Joachim Dengler Oct. 1990 36 p
(Contract N00014-85-K-0124)
(AD-A235512; AI-M-1265) Avail: NTIS HC/MF A03 CSCL 12/2

A new noniterative approach to determine displacement vector fields with discontinuities is described. In order to overcome the limitations of current methods, the problem is regarded as a general modelling problem. From this point of view the imaging field consists of a set of regions with common properties and their boundaries. The strategy proposed is an analysis of consistency of the displacement estimators between different levels of regularization. A fully regularized family of model based displacement vector fields is constructed by successive smoothing and subsampling. By measuring the difference in description length the compatibility between different levels of regularization is measured. This gives local but noisy evidence of possible model boundaries at multiple scales. GRA

N91-27891# Stanford Univ., CA. Dept. of Statistics.
TRUNCATED INVERSE SAMPLING PROCEDURE FOR MULTINOMIAL SUBSET SELECTION
Pinyuen Chen 7 May 1991 35 p
(Contract N00014-89-J-1627)
(AD-A235769; SU-TR-442) Avail: NTIS HC/MF A03 CSCL 12/3

A truncated inverse sampling procedure is considered for selecting a random size subset that contains the multinomial event which has the largest probability. Multinomial selection problems have been customarily treated by using two different approaches, namely, the indifference zone approach and the subset selection approach. Bechhofer, Elmaghraby and Morse(1959), adopting the indifference zone approach, proposed a fixed sample size procedure for selecting the multinomial cell which has the largest cell probability. Gupta and (1967), adopting the subset seiection approach, proposed a fixed sample size procedure for selecting a random size subset that contains the multinomial cell which has the largest probability. Inverse sampling versions of these two procedures were studied by Cacoullos and Sobel (1966) and Panchapakesan (1971), respectively. Other inverse sampling procedures for multinomial selection problems were given in Chen and Sobel (1984), Chen (1985). GRA

N91-27892# Woodward-Clyde Consultants, Pasadena, CA.
RESOLUTION OF THE pP PARADOX AT NOVAYA ZEMLYA Report, 1 Feb. - 1 Aug. 1990
L. J. Burdick 15 Dec. 1990 55 p
(Contract F19628-89-C-0216)
(AD-A235959; PL-TR-91-2042; SR-1) Avail: NTIS HC/MF A04 CSCL 17/10

One of the most significant problems remaining in the field of relating m sub b to yield is to correctly assess the significance of the pP arrival on amplitude. At the Noyvaya Zemlya test site in particular, estimates of the relative amplitude ratio of pP to P vary by a factor of five. Two alternate techniques which are designed to efficiently process large amounts of short period body wave data from multiple events and reduce it to estimates of relative pP amplitude have been applied to two different Novaya Zemlya data sets by two different research groups. The first method, known as network spectral averaging, consistently indicates that this relative amplitude is of the order of 0.2. The second method, known as intercorrelation, indicates that this value is of the order of 1.0 or that the reflected pP is slightly larger than a reflected elastic pulse would be. In this study, the former approach has been applied to the data set from the latter study. There are two purposes. The first is to investigate whether differences in selection and processing of the data could account for the paradox, and the second is to attempt to isolate and explain its cause. The result of applying the spectral averaging approach to the intercorrelation data set was essentially a confirmation of the paradox. The indication of the spectral analysis was that the relative amplitude of pP was indeed about 0.2. The other parameters estimated from the alternative analysis procedures, such as pP - P time delay, agreed closely. GRA

N91-27893# Wisconsin Univ., Madison. Center for Mathematical Sciences.
SOME PROBLEMS IN NONLINEAR ANALYSIS Final Technical Report, 1 Dec. 1987 - 30 May 1991
M. G. Crandall and P. H. Rabinowitz 30 May 1991 4 p
(Contract N00014-88-K-0134)
(AD-A236246) Avail: NTIS HC/MF A01 CSCL 12/2

The following subject areas are covered: theoretical basis for Hamilton-Jacobi equations in infinite dimensions and developing a theoretical foundation for dynamic programming in infinite dimensional control and differential games; presentation of the theory of viscosity solutions of fully nonlinear second order partial differential equations; functional analytical framework for the discussion of evolutions generated by operators like the Laplacian; periodic solutions of Hamiltonian systems; existence of various kinds of connecting orbits for Hamiltonian systems such as heteroclinic and homoclinic orbits; results for superlinear problems; and standing wave solutions of nonlinear Schroedinger equations. GRA

N91-27894# New York Univ., New York. Courant Inst. of Mathematical Sciences.
NONLINEAR, HYPERBOLIC AND INVERSE PROBLEMS Final Report, 1 Oct. 1984 - 31 Mar. 1991
Cathleen S. Morawetz 31 Mar. 1991 5 p
(Contract N00014-85-K-0195)
(AD-A236250) Avail: NTIS HC/MF A01 CSCL 20/1

The following subject areas are covered: transonic flow, direct and inverse problems of wave propagation; and nonlinear p.d.e. using topological methods. The following topics are included: (1) acoustic scattering; (2) transonic flow; (3) reflection of a plane shock by a wedge; and (4) mixed equations in plasmas. GRA

N91-27895# Naval Postgraduate School, Monterey, CA. Dept. of Mathematics.
ELLIPTIC INTEGRALS IN THE MINKOWSKI PLANE Technical Report, Oct. 1990 - May 1991
Mostafa Ghandehari and Dave Logothetti 9 May 1991 17 p
(AD-A236710; NPS-MA-91-012) Avail: NTIS HC/MF A03 CSCL 12/1

Expressions for the perimeter of the unit circle of a normal linear plane in terms of elliptic integrals of the first and second kinds are given. Asymptotic results, where the center is close to the boundary are discussed. An affine transformation is used to obtain similar results for an ellipse. GRA

N91-27896# Harvard Univ., Cambridge, MA. Dept. of Statistics.
ASYMPTOTIC DISTRIBUTION OF THE LIKELIHOOD RATIO TEST THAT A MIXTURE OF TWO BINOMIALS IS A SINGLE BINOMIAL
Herman Chernoff and Eric Lander May 1991 30 p Prepared in cooperation with Massachusetts Inst. of Tech., Cambridge
(Contract N00014-91-J-1005)
(AD-A236714; ONR-C-7) Avail: NTIS HC/MF A03 CSCL 12/3

A problem of interest in genetics is that of testing whether a mixture of two binomial distributions B sub i (k, p) and B sub i (k, 1/2) is simply the pure distribution B sub i (k, 1/2). This problem arises in determining whether a genetic marker is present for a gene responsible for a heterogeneous trait, that is a trait which is caused by any one of several genes. In that event, a nontrivial mixture is given involving 0 less than p less than 0.5 where p is a recombination probability. Standard asymptotic theory breaks down for such problems which belong to a class of problems where a natural parameterization represents a single distribution, under the hypothesis to be tested, by infinitely many possible parameter points. That difficulty may be eliminated by a transformation of parameters. But in that case a second problem appears. The regularity conditions demanded by the applicability of the Fisher Information fails when k greater than 2. An approach is presented where use is made of the Kullback Leibler information, of which the Fisher information is a limiting case. Several versions of the binomial mixture problem are studied. GRA

N91-27897# Naval Ocean Systems Center, San Diego, CA.
FITTING OF DISCRETE IRREGULARLY SPACED DATA WITH DIFFERENTIABLE FUNCTIONS: APPLICATION TO RAY TRACING IN THE IONOSPHERE Final Report
A. K. Paul Mar. 1991 25 p
(AD-A236770; NOSC/TR-1405) Avail: NTIS HC/MF A03 CSCL 12/1

Frequently, data are collected at irregularly spaced grid points, and for a variety of reasons, there is usually a need for interpolation; for example, a two dimensional graphical representation in the form of maps showing contour lines of constant values (isobars in weather maps). In many cases, this is not a trivial task, especially when the grid points are irregular and large data gaps exist. This problem, as it exists for ionospheric data, was discussed by Rush et al. If the data can be fitted with a continuous function that has continuous partial derivatives, the computation of contour lines is relatively easy. The electron density in the ionosphere at a given time is a function of latitude, longitude, and height. Horizontal gradients of the electron density can cause significant deviation of the ray path distance and direction from that expected under the assumption of horizontal stratification of the ionosphere. To improve propagation predictions under such circumstances, ray tracing studies that require the knowledge of the density and its gradient for every point along each ray path are needed. Similar remarks apply to the vertical sounding of the ionosphere, where horizontal gradients cause deviation from vertical propagation and limit the accuracy of electron density profile calculations unless angle of arrival data are available and corresponding corrections can be obtained by means of ray tracing. GRA

N91-27898# Naval Postgraduate School, Monterey, CA. Dept. of Administrative Sciences.
DIMENSIONAL ANALYSIS IN MATHEMATICAL MODELING SYSTEMS: A SIMPLE NUMERICAL METHOD
Hemant K. Bhargava Feb. 1991 23 p
(AD-A236904; NPS-AS-91-010) Avail: NTIS HC/MF A03 CSCL 12/1

Dimensional manipulation, essentially a problem requiring symbolic techniques, is discussed using a numerical method which obeys the laws of dimensional arithmetic. This is achieved by specifying an encoding of units of measurement as prime numbers, and manipulating the resulting expressions numerically. The factorization theorem is applied to show that this method makes trivial the problems of dimensional simplification and verification of dimensional equivalency, which are central issues in dimensional arithmetic. The solution has immediate application in mathematical modeling system, chiefly in the model validation and model solution phases. GRA

N91-27899# Naval Ocean Systems Center, San Diego, CA.
GEOMETRIC CHARACTERIZATION OF EIGENVALUES OF COVARIANCE MATRIX FOR TWO-SOURCE ARRAY PROCESSING
S. I. Chou May 1991 6 p
(AD-A236923) Avail: NTIS HC/MF A02 CSCL 12/2

For a two-source array processing scenario, normalized eigenvalues' expressions lambda sub 1 and lambda sub 2 are reduced to forms depending only on a real triplet: phase-dependent, variable xi, phase-independent variable eta, and a certain power ratio is confined to an isosceles-like region. We characterize: (1) this isosceles-like region and the many-to-one mapping from the Cartesian product of the temporal and spatial correlation unit-disks onto this region; (2) the behavior of the eigenvalues and their ratio as functions of the real triplet with respect to array processing, and; (3) a characterization of Speiser's eigenvalues bounds specialized to the two source scenario. GRA

N91-27900# Pittsburgh Univ., PA. Inst. for Computational Mathematics and Applications.
A GEOMETRIC TREATMENT OF IMPLICIT DIFFERENTIAL-ALGEBRAIC EQUATIONS
Patrick J. Rabier and Werner C. Rheinboldt May 1991 47 p
(Contract N00014-90-J-1025; AF-AFOSR-0094-90; NSF CCR-89-07654)
(AD-A236991; ICMA-91-162) Avail: NTIS HC/MF A03 CSCL 12/1

A differential geometric approach for proving the existence and uniqueness of solutions of implicit differential algebraic equations is presented. It provides for a significant improvement of an earlier theory developed by the authors as well as for a completely intrinsic definition of the index of such problems. The differential algebraic equation is transformed into an explicit ordinary differential equation by a reduction process that can be abstractly defined for specific submanifolds of tangent bundles here called reducible pi-submanifolds. Local existence and uniqueness results for differential-algebraic equations then follow directly from the final stage of this reduction by means of an application of the standard theory of ordinary differential equations. GRA

N91-27901*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, OH.
EXPONENTIAL INTEGRATION ALGORITHMS APPLIED TO VISCOPLASTICITY
Alan D. Freed and Kevin P. Walker (Engineering Science Software, Inc., Smithfield, RI.) 1991 17 p Proposed for presentation at the Third International Conference on Computational Plasticity Fundamentals and Applications (COMPLAS 3), Barcelona, Spain, 6-10 Apr. 1992; sponsored by the Centro Internacional de Methodos Numericos en Ingenieria
(NASA-TM-104461; E-6302; NAS 1.15:104461) Avail: NTIS HC/MF A03 CSCL 12A

Four, linear, exponential, integration algorithms (two implicit, one explicit, and one predictor/corrector) are applied to a viscoplastic model to assess their capabilities. Viscoplasticity comprises a system of coupled, nonlinear, stiff, first order, ordinary differential equations which are a challenge to integrate by any means. Two of the algorithms (the predictor/corrector and one of the implicits) give outstanding results, even for very large time steps. Author

N91-28073*# Clark-Atlanta Univ., GA. Dept. of Mathematics.
CONSTRUCTION OF STABLE EXPLICIT FINITE-DIFFERENCE SCHEMES FOR SCHROEDINGER TYPE DIFFERENTIAL EQUATIONS
Ronald E. Mickens *In* Alabama A & M Univ., NASA-HBCU Space Science and Engineering Research Forum Proceedings 1989 p 47-52 (For primary document see N91-28063 19-99)
Avail: NTIS HC/MF A23 CSCL 12A

65 STATISTICS AND PROBABILITY

Includes data sampling and smoothing; Monte Carlo method; and stochastic processes.

N91-27902# Weapons Systems Research Lab., Adelaide (Australia).
A PROCEDURE FOR GENERATING RUN-SYNCHRONISED DISJOINT STREAMS OF PSEUDO-RANDOM NUMBERS FOR USE IN SIMULATION
M. L. Scholz Sep. 1990 28 p
(AD-A236027; WSRL-TN-46/89; DODA-AR-005-938) Avail: NTIS HC/MF A03 CSCL 12/3

A procedure for generating-disjoint streams of pseudo-random numbers for use in discrete event simulation is presented. The procedure facilitates the synchronization of variates from run to run and can be employed in conjunction with several variance reduction techniques. It is based on Schrage's implementation of the Lehmer generator and includes enhancements to remove the restriction on usable multiplier values. Seeds are efficiently computed by a routine that exploits the number-theoretic properties of congruences. Machine-portable FORTRAN routines are listed for use on machines capable of performing 31-bit signed integer arithmetic. GRA

N91-27903# Illinois Univ., Urbana. Dept. of Statistics.
THE ASYMPTOTIC POSTERIOR NORMALITY OF THE LATENT TRAIT IN AN IRT MODEL Technical Report No. 4, 1988 - 1991
H. H. Chang and William Stout 25 May 1991 48 p
(Contract N00014-90-J-1940; NR Proj. RR0-4204)
(AD-A236646) Avail: NTIS HC/MF A03 CSCL 12/3

It has long been part of the Item Response Theory (IRT) folklore that under the usual empirical Bayes unidimensional IRT modeling approach, the posterior distribution of examinee ability given test response is approximately normal for a long test. Under very general non-parametric assumptions, we make this claim rigorous for a broad class of latent models. GRA

N91-27904# Harvard Univ., Cambridge, MA. Dept. of Statistics.
NUMERICAL SOLUTIONS FOR BAYES SEQUENTIAL DECISION APPROACH TO BIOEQUIVALENCE PROBLEM
Jing-Shiang Hwang Mar. 1991 29 p
(Contract N00014-91-J-1005)
(AD-A236707; TR-ONR-C-6) Avail: NTIS HC/MF A03 CSCL 12/3

Bioequivalence is an important area of pharmaceutical research containing many questions which are not yet resolved. Various statistical approaches have been discussed in the literatures. We address stopping rules for testing bioequivalence from a decision-theoretic point of view. The numerical techniques for Bayes sequential decision problem are employed to obtain explicit descriptions of the solutions of the continuous time optimal stopping problem on bioequivalence. GRA

66 SYSTEMS ANALYSIS

Includes mathematical modeling; network analysis; and operations research.

N91-27905# Air Univ., Maxwell AFB, AL. Airpower Research Inst.
SPACE CONTROL AND THE ROLE OF ANTISATELLITE WEAPONS
Steven R. Petersen May 1991 134 p
(AD-A236844; AU-ARI-90-7) Avail: NTIS HC/MF A07 CSCL 15/6

The United States seems headed toward a period of military austerity reflected in a substantially reduced force structure. As terrestrial weapons systems are reduced, space systems increase in numbers and applications. This study represents the first effort to tie together, in one document, U.S. doctrine, policy, and implementation planning for the use of offensive weapons in space. Structured around the concept of space control, the author creates a picture of offensive space operations that are quite similar to traditional air superiority operations. This study provides a timely guide to the evolution of space as another theater of warfare. It identifies key doctrinal and operational challenges that lie ahead. GRA

67 THEORETICAL MATHEMATICS

Includes topology and number theory.

No abstracts in this category.

70 PHYSICS (GENERAL)

For precision time and time interval (PTTI) see *35 Instrumentation and Photography;* for geophysics, astrophysics or solar physics see *46 Geophysics, 90 Astrophysics,* or *92 Solar Physics.*

N91-27906# Stanford Linear Accelerator Center, CA.
ON FEYNMAN'S PROOF OF THE MAXWELL EQUATIONS
H. P. Noyes Mar. 1991 2 p Presented at the 30th Internationale Universitatswoken Fuer Kernphysik, Schladming (Austria), 27 Feb. - 8 Mar. 1991
(Contract DE-AC03-76SF-00515)
(DE91-011758; SU-SLAC-Pub-5411; CONF-9102113-1) Avail: NTIS HC/MF A01

Dyson has presented a derivation of the free space Maxwell Equations and the Lorentz force starting from Newton's Second Law and the commutation relations between x(sub i), x(sub j), and x(sub k). The proof is attributed to Feynman. The reason why it works is puzzling. The finite and discrete reconciliation between relativity and quantum mechanics offers a less problematic logical chain. The mass ratios are defined using deBroglie wave interference in a theory which necessarily entails the commutation relations. It is shown that this route implies Newton's Third Law. Following Mach, Newton's Second Law then becomes a definition of force, and given this the Lorentz force becomes a definition of the electromagnetic fields. The use of the relativistic Zitterbewegun with the step length h/mc consistently introduces the limiting velocity c into the calculation, and removes a puzzle about dimensions from the Feynman results. By adopting the Wheeler-Feynman point of view that the energy and momenta of massless quanta are defined by the sources and sinks, the inhomogeneous Maxwell equations are derived from quantum particle physics - which Feynman was unable to do - and hence the classical electromagnetic theory was established as a well defined continuum approximation to the fully discrete relativistic quantum mechanics. Exploration of quantum gravity along these lines appears to be promising. Author

N91-27907# Joint Publications Research Service, Arlington, VA.
JPRS REPORT: SCIENCE AND TECHNOLOGY. USSR: PHYSICS AND MATHEMATICS
6 Jun. 1991 30 p Transl. into ENGLISH from various Russian articles
(JPRS-UPM-91-004) Avail: NTIS HC/MF A03

Abstracts of Soviet research projects in the areas of mathematics and physics are presented. The following areas are covered: acoustics; nuclear physics; optics, spectroscopy; plasma physics; and superconductivity. K.S.

N91-27908# Joint Publications Research Service, Arlington, VA.
JPRS REPORT: SCIENCE AND TECHNOLOGY. USSR: PHYSICS AND MATHEMATICS
1 Jul. 1991 28 p Transl. into ENGLISH from various Russian articles
(JPRS-UPM-91-005) Avail: NTIS HC/MF A03

Abstracts of Soviet literature in various areas of physics and mathematics are compiled. The following subject areas are covered: acoustics, lasers, nuclear physics, optics and spectroscopy, plasma physics, and superconductivity. Author

71 ACOUSTICS

Includes sound generation, transmission and attenuation. For noise pollution see *45 Environmental Pollution.*

N91-27909*# Florida Atlantic Univ., Boca Raton. Dept. of Ocean Engineering.
EXPERIMENTAL MEASUREMENT OF STRUCTURAL POWER FLOW ON AN AIRCRAFT FUSELAGE Progress Report No. 6, Jan. - Jun. 1989
J. M. Cuschieri Jun. 1991 25 p

(Grant NAG1-685)
(NASA-CR-187560; NAS 1.26:187560) Avail: NTIS HC/MF A03 CSCL 20A

An experimental technique is used to measure structural intensity through an aircraft fuselage with an excitation load applied near one of the wing attachment locations. The fuselage is a relatively large structure, requiring a large number of measurement locations to analyze the whole of the structure. For the measurement of structural intensity, multiple point measurements are necessary at every location of interest. A tradeoff is therefore required between the number of measurement transducers, the mounting of these transducers, and the accuracy of the measurements. Using four transducers mounted on a bakelite platform, structural intensity vectors are measured at locations distributed throughout the fuselage. To minimize the errors associated with using the four transducer technique, the measurement locations are selected to be away from bulkheads and stiffeners. Furthermore, to eliminate phase errors between the four transducer measurements, two sets of data are collected for each position, with the orientation of the platform with the four transducers rotated by 180 degrees and an average taken between the two sets of data. The results of these measurements together with a discussion of the suitability of the approach for measuring structural intensity on a real structure are presented. Author

N91-27910*# National Aeronautics and Space Administration. Langley Research Center, Hampton, VA.
AN ULTRASONIC TECHNIQUE TO MEASURE THE DEPTH OF BURN WOUNDS IN HUMANS
William T. Yost, John H. Cantrell, and Pamela D. Hanna (Analytical Services and Materials, Inc., Hampton, VA.) Jun. 1991 163 p
(NASA-TM-104116; NAS 1.15:104116) Avail: NTIS HC/MF A08 CSCL 20A

Whenever ultrasound encounters discontinuity in its medium of propagation, some energy is reflected from the interface. Such reflections or echoes occur when incident energy encounters the front skin, viable/necrotic, and dermis/fat skin tissue interfaces. It was shown that the most probable cause of the viable/necrotic interface is the uncoiling of collagen in the necrotic tissue, which can cause a reflection at the viable/necrotic interface of approximately 10 percent of the wave amplitude, and is approximately the same as that from the other two interfaces noted. The instrument, still in the prototype stage, was designed to detect the various reflections from within the skin layer. It is shown that, by studying the timing between the various echoes, one can use ultrasound as an aid in diagnosing the depth of burned skin tissue in humans. The instrument is a 60-MHz A-scan unit, modified to more easily identify the echoes occurring within the short time interval during which the reflections are received from the skin layers. A high frequency unit was selected so that various transducers could be utilized to optimize the system. Signal conditioning circuits were modified and added to provide an adequate display of the principle reflections expected. The unit was successful in studying burned tissue in pigs and was recently used to study burn wounds in humans. Measurement techniques and preliminary results are presented. Author

N91-27911# Naval Research Lab., Washington, DC.
RESULTS ON CANCELLER CONVERGENCE IN NONSTATIONARY NOISE Interim Report
Karl Gerlach 14 Mar. 1991 29 p
(AD-A236195; NRL-9312) Avail: NTIS HC/MF A03 CSCL 17/4

Convergence results for the Sampled Matrix Inversion (SMI)/Gram-Schmidt (GS) canceller algorithm in nonstationary noise is investigated by using the Gram-Schmidt (GS) canceller as an analysis tool. Lower and upper bounds for the convergence rate of the canceller's average output noise power residue normalized to the quiescent average output noise power residue are derived. These bounds are a function of the number of independent samples processed per channel (main and auxiliary), the number of auxiliary input channels, and the external noise environment. The external noise environment was modeled as Gaussian, with a power level specified at each sampling time instant. Furthermore, this model is generalized in the sense that a joint probability distribution function is defined for the power levels over a canceller processing batch. This leads to the capability of modeling and evaluating the SMI/GS canceller in a variety of interference scenarios such as continuous or discrete time processes or a mix of these. GRA

N91-27912# Materials Research Labs., Ascot Vale (Australia).
ACOUSTIC REFLECTION FROM A PLANE BOUNDARY HAVING VARIABLE SURFACE PARAMETERS
C. I. Sach Mar. 1991 19 p
(AD-A236832; MRL-TN-581; DODA-AR-006-333) Avail: NTIS HC/MF A03 CSCL 20/1

A possible technique for studying the acoustic reflection from continuous plane surfaces such as flat plates covered with thin anechoic coatings is discussed. It is particularly directed to complex coatings which include a regular array of non-homogeneous inclusions within their structures. The method involves the experimental determination of a position-dependent quantity which can be viewed as either a surface transfer admittance or a surface transfer mobility function. This function can then be used in a mathematical convolution procedure to determine the nature of the reflected wave from the surface when it is ensonified by an incident uniform plane wave arriving in a direction normal to the plate surface. The basic theory behind the proposed method is presented for a surface having a periodic, two-dimensional spatial variation. As a side issue, this approach raises a question as to the applicability of an average surface admittance approach used previously to estimate reflection coefficients of Alberich coatings. The basic elements of an experimental system for measuring the surface admittance functions are discussed. GRA

N91-27913* National Aeronautics and Space Administration. Langley Research Center, Hampton, VA.
SOUND ATTENUATION APPARATUS Patent
Kevin P. Shepherd, inventor (to NASA) and Ferdinand M. W. A. Grosveld, inventor (to NASA) (Planning Research Corp., Hampton, VA.) 18 Jun. 1991 11 p Filed 10 Aug. 1989
(NASA-Case-LAR-13968-1; US-Patent-5,024,288; US-Patent-Appl-SN-392165; US-Patent-Class-181-206; US-Patent-Class-181-286; US-Patent-Class-181-290; US-Patent-Class-181-295; US-Patent-Class-381-71; US-Patent-Class-381-94; US-Patent-Class-52-144) Avail: US Patent and Trademark Office CSCL 20A

An apparatus is disclosed for reducing acoustic transmission from mechanical or acoustic sources by means of a double wall partition, within which an acoustic pressure field is generated by at least one secondary acoustic source. The secondary acoustic source is advantageously placed within the partition, around its edges, or it may be an integral part of a wall of the partition.
Official Gazette of the U.S. Patent and Trademark Office

N91-27914* National Aeronautics and Space Administration. Langley Research Center, Hampton, VA.
METHOD AND APPARATUS FOR CHARACTERIZING REFLECTED ULTRASONIC PULSES Patent
William T. Yost, inventor (to NASA) and John H. Cantrell, Jr., inventor (to NASA) 16 Jul. 1991 32 p Filed 17 Oct. 1989
(NASA-Case-LAR-13966-1; US-Patent-5,031,627; US-Patent-Appl-SN-422726; US-Patent-Class-128-660.06; US-Patent-Class-73-631; Int-Patent-Class-A61B-8/00) Avail: US Patent and Trademark Office CSCL 20A

The invention is a method of and apparatus for characterizing the amplitudes of a sequence of reflected pulses R1, R2, and R3 by converting them into corresponding electric signals E1, E2, and E3 to substantially the same value during each sequence thereby restoring the reflected pulses R1, R2, and R3 to their initial reflection values by timing means, an exponential generator, and a time gain compensator. Envelope and baseline reject circuits permit the display and accurate location of the time spaced sequence of electric signals having substantially the same

amplitude on a measurement scale on a suitable video display or oscilloscope.
Official Gazette of the U.S. Patent and Trademark Office

N91-27915# Technische Hogeschool, Delft (Netherlands).
TIME-DOMAIN FINITE-ELEMENT METHOD FOR THE COMPUTATION OF THREE-DIMENSIONAL ACOUSTIC WAVE FIELDS IN INHOMOGENEOUS FLUIDS AND SOLIDS Ph.D. Thesis
H. J. Stam 21 Jun. 1990 235 p
(PB91-180877) Avail: NTIS HC/MF A11 CSCL 20A

A hybrid method is presented that solves numerically space-time acoustic wave problems in a configuration that may consist of fluid and solid parts. The fluids and solids are taken to be linear, and instantaneously reacting, and time invariant in their mechanical behavior. In some bounded domain D(sup sc) the medium is arbitrarily inhomogeneous and anisotropic. The embedding of this domain is a fluid or a solid whose properties are so simple that its Green's function can be constructed by analytical methods. The fluid-domain acoustic wave fields are characterized by their particle velocity and their scalar traction; the solid-domain acoustic wave fields are characterized by their particle velocity and their stress; these quantities are regarded as the fundamental state variables and will henceforth be referred to as the acoustic state quantities. The bounded domain of numerical computation D is taken such that D(sup sc) is included in D. The computation of the wave fields in D is carried out by a finite-element method that is suited to handle, in particular, the conditions at arbitrarily shaped boundaries and interfaces of the solid/solid, fluid/fluid, and the solid/fluid types. GRA

N91-27916*# Georgia Tech Research Inst., Atlanta.
AN UPDATED CATALOG OF 318 SOCIAL SURVEYS OF RESIDENTS' REACTIONS TO ENVIRONMENTAL NOISE (1943-1989)
James M. Fields Jun. 1991 169 p
(Contract NAS1-19061)
(NASA-CR-187553; NAS 1.26:187553) Avail: NTIS HC/MF A08 CSCL 20A

All social surveys of residents' reactions to environmental noise in residential areas which were described in English language publications from 1943 to 1989 are identified. A total of 318 surveys are described. The surveys are indexed by country, noise source, and data of survey. The publications and reports from each survey are listed in a bibliography. Twenty-four surveys are listed which are available for secondary analysis from a data archive. Author

72 ATOMIC AND MOLECULAR PHYSICS

Includes atomic structure, electron properties, and molecular spectra.

N91-27917# Royal Aircraft Establishment, Farnborough (England).
EXPERIMENTS WITH THE FIRST RAE ELECTRON BOMBARDMENT ION EXCHANGE
B. P. Day and R. Hastings Feb. 1971 66 p
(RAE-TR-71023; RAE-Space-358; BR25201; ETN-90-90940)
Copyright Avail: NTIS HC/MF A04

The early development work on a mercury electron bombardment ion engine at the Royal Aircraft Establishment (RAE) is described, covering the period May 1968 to March 1970. Results from the earliest version using an oxide cathode are given. A comparison is made with results from the same engine using a hollow cathode and a modified magnetic field. The facilities and laboratory power supplies are also briefly described. Author

N91-27918# Air Force Systems Command, Wright-Patterson AFB, OH. Foreign Technology Div.
A COLLECTION OF SELECTED PAPERS FROM THE THIRD ALL-CHINA ELECTROEMISSIONS TECHNOLOGY CONFERENCE (SELECTED PAGES)
21 Mar. 1991 85 p Transl. into ENGLISH from Chinese Conference, Field Emission, no. 3, 1990 p 7-25, 35, 42-59 Conference held in Peoples Rep. of China, 21-25 May 1990
(AD-A234803; FTD-ID(RS)T-1367-90) Avail: NTIS HC/MF A05 CSCL 20/7

Topics addressed include: electroemission microtechnology; electroemission electron sources and vacuum microelectronics technology; theory and calculation of electroemissions; research on the microstructure of materials; surface properties and thin membranes; electroemissions and flat plate display screens; and test manufacture of component parts for electroemission equipment. B.G.

N91-27919# Michigan Univ., Ann Arbor. Dept. of Physics.
THE 12TH INTERNATIONAL CONFERENCE ON ATOMIC PHYSICS Final Report
Robert R. Lewis and Arthur Rich 19 Feb. 1991 301 p Conference held in Ann Arbor, MI, 29 Jul. - 3 Aug. 1990
(Grant AF-AFOSR-0275-90)
(AD-A234876; AFOSR-91-0268TR) Avail: NTIS HC/MF A14 CSCL 20/5

The conference began with a session devoted to the Nobel Laureates in Physics for 1989, all of whom were from the Atomic Physics community; Norman Ramsey and Hans Dehmelt spoke but Wolfgang Paul was unable to attend. Some sessions were titled as follows: Fundamental Laws and Constants; Atom and Ion Manipulation; Nonlinear Physics and Chaos; Quantum Optics and Other Laser Techniques; Photoionization Processes; Plasma Physics; Atomic Spectroscopy and Structure - Theory; Atomic Spectroscopy and Structure - Experimental; Molecular Spectroscopy and Structure, Surfaces, and Clusters; Atomic, Ionic, and Molecular Collisions; Electron and Positron Collisions; and Exotic Atomic and Special Topics. Author

N91-27920# Argonne National Lab., IL.
PHOTOINDUCED CHARGE SEPARATION AND RECOMBINATION: THE INFLUENCE OF MEDIUM ON RATES AND ENERGETICS
M. R. Wasielewski, G. L. Gaines, M. P. ONeil, W. A. Svec, and M. P. Niemczyk 1991 4 p Presented at the 29th Yamada Conference on Dynamics and Mechanisms of Photoinduced Electron Transfer and Related Phenomena, Osaka (Japan), 12-16 May 1991
(Contract W-31-109-eng-38)
(DE91-010267; ANL/CP-72746; CONF-9105158-1) Avail: NTIS HC/MF A01

Recent interest in the role of the solvent in electron transfer reactions has focused on ultrafast photoinduced electron transfers, highlighted by investigations into the primary events of bacterial photosynthesis. Rates of photoinduced charge separation proceeding from the lowest excited singlet state in 14 fixed-distance porphyrin triptycene acceptor molecules were measured in 2-methyl tetrahydrofuran glass at 77 K. Analysis of the rate data as a function of free energy of reaction reveals that the ion-pair state of the oxidized donor and reduced acceptor is destabilized in a rigid glass medium by 0.8 eV relative to the ion-pair state energy determined from the sum of the one-electron redox potentials for the donor and acceptor in polar liquids. The measured value of this destabilization energy agrees remarkably well with predictions based on the dielectric continuum model of the solvent. From the maximum of the rate vs free energy profile for photoinduced charge separation, the total reorganization energy of the reaction is 0.6 eV. Analysis of this data shows that the solvent reorganization energy is 0.3 eV, while the internal nuclear reorganization energy of the donor-acceptor molecules is 0.3 eV. DOE

N91-27921# Los Alamos National Lab., NM.
COMPETING ELECTRON-ELECTRON/ELECTRON-PHONON INTERACTIONS AND POLYACETYLENE
J. T. Gammel, D. K. Campbell, and E. Y. Loh, Jr. (Thinking Machines Corp., Cambridge, MA.) Apr. 1991 9 p Presented at the International Winter School on Electronic Properties of Polymers, Kirchberg (Austria), 9-16 Mar. 1991

(Contract W-7405-eng-36)
(DE91-011389; LA-UR-91-1204; CONF-9103167-1) Avail: NTIS HC/MF A02

Using Lanczos exact diagonalization, we investigate the effects of the competition between the electro-electron and electron-phonon interactions in the context of the 1-D tight-binding Peierls-Hubbard Hamiltonian, studying various structural, optical, and vibrational properties of strongly correlated systems. We use polyacetylene as our experimental guide, and perform a parameter space search to determine the level at which a unique set of parameters can model this prototypical conducting polymer and, more generally, the applicability of the simple 1-D Peierls-Hubbard Hamiltonian to these highly interesting materials. DOE

N91-27922# Minnesota Univ., Minneapolis. Dept. of Chemistry.
ULTRAFAST CHARGE SEPARATION IN ADMA EXPERIMENT, SIMULATION, AND THEORETICAL ISSUES
Keisuke Tominaga, Gilbert C. Walker, and Wlodzimierz Jarzeba 6 May 1991 63 p
(Contract N00014-89-J-1746)
(AD-A235486; TR-8) Avail: NTIS HC/MF A04 CSCL 20/5

Excited state intramolecular charge separation in organic electron donor/acceptor (D-A) compounds has become an important model reaction for studying the mechanism of small barrier electron transfer (et) reactions. In this paper we present new ultrafast fluorescence measurements on the excited states of dynamics of 4-(9-anthryl)-N, N'-dimethylaniline (ADMA), especially on the excited state et process (D-A* = D+ -A-, conventionally denoted by LE= CT). Employing an extension of the semi-empirical model of Kang et al., the results have been analyzed leading to several conclusions. First, the variation in the static absorption and emission spectra of ADMA, as a function of solvent, is primary due to simple solvent coordinate effects, rather than large intramolecular structural changes. Second, in polar solvents the excited state et (LE = CT) of ADMA is in the Marcus inverted regime. Third, there are two distinct et kinetic components, a faster (less than 150 fs) component which is not solvent controlled and probably involves intramolecular bath states: and a slower solvent controlled component with a limiting rate constant. GRA

N91-27923# Minnesota Univ., Minneapolis. Dept. of Chemistry.
ULTRAFAST STUDIES ON ELECTRON TRANSFER
Paul F. Barbara, Keisuke Tominaga, and Gilbert C. Walker 6 May 1991 19 p
(Contract N00014-89-J-1746)
(AD-A235487; TR-7) Avail: NTIS HC/MF A03 CSCL 20/5

Excited state intramolecular charge separation in organic electron donor/acceptor (D-A) compounds has become an important model reaction for studying the mechanism of small barrier electron transfer (et) reactions. In this paper we present new ultrafast fluorescence measurements on the excited states dynamics of 4-(9-anthryl)-N, N'-dimethylaniline (ADMA), especially on the excited state et process (D-A* = D+ -A-, conventionally denoted by LE = CT). The variation on the static absorption and emission spectra of ADMA, as a function of solvent, is primary due to simple solvent coordinate effects, rather than large intramolecular structural changes. In polar solvents the excited state et of ADMA is in the Marcus inverted regime. There are two distinct et kinetic components, a faster component which is not solvent controlled and probably involves intramolecular bath states: and a slower solvent controlled component with a limiting rate constant. GRA

N91-27924# Minnesota Univ., Minneapolis. Dept. of Chemistry.
ULTRAFAST MEASUREMENTS ON DIRECT PHOTOINDUCED ELECTRON TRANSFER IN A MIXED VALENCE COMPLEX
Gilbert C. Walker, Paul F. Barbara, Stephen K. Doorn, Yuhua Dong, and Joseph T. Hupp 6 May 1991 23 p
(Contract N00014-89-J-1746)
(AD-A235572; TR-10) Avail: NTIS HC/MF A03 CSCL 07/4

In this paper, we report the first direct kinetic measurement of a MMCT optically induced et reaction, and compare the experimental results to theoretical predictions using experimentally estimated parameters. Our work is oriented, in part, toward evaluating contemporary theoretical models that explicitly consider the dramatic effect of solvation dynamics on et rates. In the last decade it has been established that et rates can be directly proportional to the time scale for solvent motion for simple systems in certain limits. The transient pump-probe apparatus has been described elsewhere. The laser source is an intermediate repetition rate (8.2 kHz) amplified dye laser with 70 fs pulse duration. The energy of the pump and probe pulses were typically 400 and 20 nj, respectively. GRA

N91-27925# Minnesota Univ., Minneapolis. Dept. of Chemistry.
REACTION IN RATES IN THE PHENOMENOLOGICAL ADIABATIC EXCITED STATE ELECTRON TRANSFER THEORY
Keisuke Tominaga, Gilbert C. Walker, Tai J. Kang, Paul F. Barbara, and Teresa Fonseca 6 May 1991 46 p
(Contract N00014-89-J-1746)
(AD-A235583; TR-9) Avail: NTIS HC/MF A03 CSCL 20/5

The recently described phenomenological model strongly adiabatic electron transfer (et) in the lowest excited state S1 of donor/acceptor molecules has been developed in more detail. The model has been generalized to include simultaneously two types of electron transfer, namely adiabatic et in S1 and diabatic et (S2 to S1). A general definition of the et reactant survival probability is given in terms of the surviving charge of the donor. A relationship between the survival probability and the integrated emission intensity from S1 and S2 is established. The use of this model is demonstrated employing the recent simulation results from our group on the excited state et of bianthryl (BA and 4-(9-anthryl)-N,N'-dimethylaniline (ADMA). GRA

N91-27926# Cornell Univ., Ithaca, NY. Dept. of Chemistry.
INVESTIGATION OF THE Si(111)-(/3x/3)R30 C-BORON SURFACE RECONSTRUCTION BY SIMULATED ANNEALING
Y.-T. Wong, B. Schubert, and R. Hoffman 25 Apr. 1991 26 p
(Contract N00014-89-J-1052)
(AD-A235671; TR-56) Avail: NTIS HC/MF A03 CSCL 07/2

In Monte Carlo and molecular dynamics simulations, millions of geometrical configurations are explored. A quick calculation of the energy of a many-body system is crucial. Of all the computational techniques in quantum chemistry, the extended Huckel method is one of the most economic. Although simplistic, it often gives valuable qualitative results in appropriately selected applications. It can be modified to give reasonable geometries of molecules. A combination of molecular dynamics and Monte Carlo simulations with the extended Huckel method should be useful in studying dynamic phenomena near surfaces and in solid state. We have taken the first step by studying the reconstruction of the Si(111) Boron surface structure using a modified extended Huckel method and Monte Carlo simulation. Our simulated annealing suggests that the reconstruction involves a three-atom rotation inside a silicon matrix instead of a direct exchange of the boron atom and the silicon atom under it. GRA

N91-27927# Wyoming Univ., Laramie. Dept. of Chemistry.
IONIC INTERACTIONS IN ELECTROACTIVE SELF-ASSEMBLED MONOLAYERS OF FERROCENE SPECIES
Technical Report No. 12, Sep. 1990 - Jun. 1991
Hugh C. DeLong, John J. Donohue, and Daniel A. Buttry 29 Apr. 1991 32 p
(Contract N00014-90-J-1167)
(AD-A235677) Avail: NTIS HC/MF A03 CSCL 07/4

The electrochemical and interfacial behavior of two types of electroactive self-assembled monolayer systems is investigated at gold electrodes. The first type is a ferrocene-based surfactant (a redox surfactant) derived from (dimethylamino)methylferrocene via quaternization of the amino group with various n-alkylbromides. These have a long alkyl chain with 16 or 18 carbons in the chain pendent from the cationic ammonium group. These are referred to as C16 and C18. The second type is a ferrocene-based dimeric species with a disulfide functional group capable of providing a permanent anchor to the Au electrode, thus endowing monolayers of this species with exceptional stability towards desorption. The

electrochemical quartz crystal microbalance (EQM) is used to monitor the mass changes which occur at the electrode surface during the redox processes of these two species. GRA

N91-27928# Lowell Univ., MA. Dept. of Chemistry.
MOLECULAR DYNAMICS SIMULATION OF SUBSTITUTED POLYACETYLENES Technical Report No. 16, 1 Jun. 1990 - 31 May 1991
X. F. Sun, S. B. Clough, S. K. Tripathy, and G. L. Baker 3 May 1991 28 p
(Contract N00014-90-J-1148)
(AD-A235853; Rept-1148-16) Avail: NTIS HC/MF A03 CSCL 07/4

Molecular mechanics and molecular dynamics calculations have been applied to several substituted polyacetylenes. Results for the barrier height for single bond rotation for polyacetylene were compared to experimental values and quantum mechanics results for low molecular weight models of polyacetylene in order to check the methodology. For poly(1-trimethyl silyl-1-propyne) barriers for rotation about a backbone single bond are approximately 40 kcal/mol. Thus the chain conformation achieved during polymerization will be maintained, though fluctuations in dihedral angles in narrow potential energy wells do allow significant changes in the chain contour. GRA

N91-27929# Utah Univ., Salt Lake City. Dept. of Chemistry.
B(+)(S-1) + H2 YEILDS BH(+)(SIGMA-2) + H: A WOODWARD-HOFFMAN FORBIDDEN ION-MOLECULE REACTION Technical Report, Dec. 1990 - Mar. 1991
Jeff Nichols, Samuel J. Cole, Maciej Gutowski, and Jack Simons 17 Apr. 1991 18 p
(Contract N00014-89-J-1497)
(AD-A235885; TR-19-ONR) Avail: NTIS HC/MF A03 CSCL 07/4

The reaction of Boron (+) (1S) with Hydrogen on the ground potential energy surface is examined using ab initio electronic structure methods. A weakly bound T-shaped B(+)...H2 complex of C2v symmetry is found to lie 855/cm below the B(+) + H2 reactant energy. Its H-H internuclear distance is only slightly distorted from that of H2; the B-H distance is much longer than the covalent bond length in BH(+). Further along the reaction coordinate is found a narrow entrance valley characterized by strong B(+)-to-H2 inter-reactant forces but very small distortion of the H-H bond length or the H-H vibrational frequency. As one proceeds further up this valley, a geometry is reached at which the asymmetric distortion mode (of B2 symmetry) develops negative curvature. Similarities and differences among reactions of the isoelectronic Beryllium, B(+), and Lithium(-) with H2 are also discussed. GRA

N91-27930# Utah Univ., Salt Lake City. Dept. of Chemistry.
AB INITIO QUANTUM CHEMISTRY STUDY OF FORMAMIDE-FORMAMIDIC ACID TAUTOMERIZATION Technical Report, Dec. 1990 - Mar. 1991
Xiao C. Wang, Jeff Nichols, Martin Feyereisen, Maciej Gutowski, and Jerry Boatz 17 Apr. 1991 27 p
(Contract N00014-89-J-1497)
(AD-A235886; TR-18-ONR) Avail: NTIS HC/MF A03 CSCL 07/4

Ab initio electronic structure calculations using analytical energy derivative methods and automated potential energy surface walking techniques were carried out on the tautomerization reaction path connecting formamide (F) H2N-CHO, through a transition state (TS), to formamidic acid (FA) HN-CHOH. The zero-point corrected F yields FA, and F yields TS energy differences are predicted to be 12.1 kcal/mol and 48.9 kcal/mol, respectively, when configuration interaction methods are used to treat electron correlation. Isotopic substitution of F to generate H2N - CDO and subsequent calculation of the harmonic vibrational frequencies and eigenvectors allowed ambiguities in the assignments of the infrared spectrum of F to be resolved. The geometry of the F tautomer is found to be slightly non-planar, but to have zero-point energy that permits the planar geometry to be dynamically accessed. Extensions to situations in which tautomerization is assisted by neighboring solvent molecule(s) are considered. In particular, the intimate involvement of a single water solvent molecule reduces the zero-point corrected F yields FA and F yields TS energy differences to 10.6 kcal/mol and 22.6 kcal/mol, respectively. Intimate solvent participation is thus found to much more strongly affect the activation energy than the overall thermodynamics in this case. GRA

N91-27931# Dalhousie Univ., Halifax (Nova Scotia). Dept. of Physics.
SELF-CONSISTENT CALCULATION OF ATOMIC ADSORPTION ON METALS IN HIGH ELECTRIC FIELDS
H. J. Kreuzer, L. C. Wang, and N. D. Lang 17 May 1991 24 p
(Contract N00014-80-J-1796)
(AD-A236205; TR-5) Avail: NTIS HC/MF A03 CSCL 20/5

Using the local density functional theory, the adsorption of a metal atom on a jellium surface in an external electrostatic field was calculated self-consistently. GRA

N91-27932# California Univ., Berkeley.
A TANDEM, MICROWAVE-DRIVEN CUSP NEGATIVE ION SOURCE Final Report, 1 Jul. 1987 - 30 Jun. 1990
E. C. Morse 20 Mar. 1991 12 p
(Grant AF-AFOSR-0333-87)
(AD-A236227; AFOSR-91-0525TR) Avail: NTIS HC/MF A03 CSCL 20/7

A microwave driven source of negative hydrogen ions was assembled and tested. The source consisted of two regions, each with separate plasma conditions. The purpose of this test was to simulate the conditions for optimized negative hydrogen yield reported theoretically. Experimentally, the ion yield followed the general trend of Hiskes' theory, but additional yield was seen by surface conversion processes on the barium cathode. GRA

N91-27933# California Univ., Irvine. Dept. of Physics.
PROPAGATION OF A NEUTRALIZED ION BEAM Final Report, 1 Aug. 1988 - 31 Oct. 1990
Norman Rostoker 17 May 1991 113 p
(Grant AF-AFOSR-0300-88; AF Proj. 2301)
(AD-A236666; AFOSR-91-0569TR) Avail: NTIS HC/MF A06 CSCL 20/7

Beam propagation experiments were performed with various plasma sources to understand the physics of plasma motion in a transverse magnetic field and magnetic diffusion in a plasma. High-beta hydrogen beams propagated by ExB drift at their initial velocity. Low-beta plasmas showed initial ExB drift, followed by deceleration, transverse compression and thermalization of the beam energy. A wide range of diamagnetism was observed. Magnetic diffusion times were consistent with those based on Hall conductivity. GRA

N91-27934# California Univ., Los Angeles. Dept. of Chemistry and Biochemistry.
THE STRUCTURE OF THE CYCLOHEXYL RADICAL FROM STATE-SELECTIVE PHOTOFRAGMENT TRANSLATIONAL SPECTROSCOPY OF THE AXIAL AND EQUATORIAL CONFORMERS OF IODOCYCLOHEXANE
John E. Freitas, Hyun J. Hwang, Amanda B. Ticknor, and M. A. El-Sayed 3 Jun. 1991 21 p
(Contract N00014-89-J-1350)
(AD-A236769; TR-69) Avail: NTIS HC/MF A03 CSCL 07/4

Iodocyclohexame (C6H11I) is photodissociated and studied with state-selective photofragment translational spectroscopy. Angular, velocity, and translational energy distributions are obtained for the ground state and the excited state photodissociated iodine atoms. Both states are formed from a one photon absorption that is dominantly parallel to the C-I dissociation coordinate and selectively ionized multiphoton absorption for detection. Both a fast and a slow velocity component are observed in the lab velocity distribution. The relative mass peak intensity is consistent with assigning the fast component to excited iodine atoms produced

from the axial conformer of iodocyclohexane, and the slow component from the equatorial conformer. GRA

N91-27935# Pennsylvania State Univ., University Park. Dept. of Chemistry.
STUDIES OF OXIDE ANIONS Final Report, Jul. 1989 - Jun. 1990
A. W. Castleman, Jr. Jun. 1991 55 p
(Contract F30602-88-D-0028)
(AD-A236812; RL-TR-91-63) Avail: NTIS HC/MF A04 CSCL 07/4

Several metal and metal oxide anion sources were used to investigate the formation and reactivity of species of relevance to the AFGL program. A new class of reactions were identified between anions of the form H(x)M(y)O(z) for several metals including M=W, Ta, Ti, Mo, and HCl. The reactions have analogy to acid-base reactions. In another series of experiments, reactions of Al(n)(-), and these clusters bound with V and or Nb, with O2 were investigated. It was found that the Jellium model, though by no means a compendious concept, provides a good guide to the electronic structure of clusters and their general patterns of reactivity. GRA

N91-27936* National Aeronautics and Space Administration. Langley Research Center, Hampton, VA.
SLOW POSITRON BEAM GENERATOR FOR LIFETIME STUDIES Patent
Jag J. Singh, inventor (to NASA), Abe Eftekhari, inventor (to NASA), and Terry L. St.Clair, inventor (to NASA) 14 May 1991 21 p Filed 31 May 1990
(NASA-Case-LAR-14250-1-SB; US-Patent-5,015,851; US-Patent-Appl-SN-531372; US-Patent-Class-250-306; US-Patent-Class-250-307; US-Patent-Class-250-358.1; Int-Patent-Class-H01J-37/00) Avail: US Patent and Trademark Office CSCL 20H

A slow positron beam generator uses a conductive source residing between two test films. Moderator pieces are placed next to the test film on the opposite side of the conductive source. A voltage potential is applied between the moderator pieces and the conductive source. Incident energetic positrons: (1) are emitted from the conductive source; (2) are passed through test film; and (3) isotropically strike moderator pieces before diffusing out of the moderator pieces as slow positrons, respectively. The slow positrons diffusing out of moderator pieces are attracted to the conductive source which is held at an appropriate potential below the moderator pieces. The slow positrons have to pass through the test films before reaching the conductive source. A voltage is adjusted so that the potential difference between the moderator pieces and the conductive source forces the positrons to stop in the test films. Measurable annihilation radiation is emitted from the test film when positrons annihilate (combine) with electrons in the test film.
Official Gazette of the U.S. Patent and Trademark Office

N91-27937# National Inst. of Standards and Technology, Gaithersburg, MD. Center for Radiation Research.
CENTER FOR RADIATION RESEARCH, 1990 TECHNICAL ACTIVITIES
C. E. Kuyatt Feb. 1991 158 p
(PB91-178855; NISTIR-4506) Avail: NTIS HC/MF A08 CSCL 20H

Summarized here are research projects, measurement method development, calibration and testing, and data evaluation activities that were carried out during FY 1991 at the National Institute of Standards and Technology (NIST) Center for Radiation Research. These activities fall into the areas of radiometric physics, radiation sources and instrumentation, and ionizing radiation. Author

N91-28077*# Florida Agricultural and Mechanical Univ., Tallahassee. Dept. of Physics.
THE PREDICTION OF PSEUDO-RESONANCE POSITIONS IN THE SCHWINGER VARIATIONAL PRINCIPLE
Charles A. Weatherford, Roy Tucker, and Gregory Odom *In* Alabama A & M Univ., NASA-HBCU Space Science and Engineering Research Forum Proceedings 1989 p 77-83 (For primary document see N91-28063 19-99)
(Contract NCC2-492)
Avail: NTIS HC/MF A23 CSCL 20H

N91-28086*# Hampton Univ., VA. Dept. of Physics.
KAON-NUCLEUS SCATTERING
Byungsik Hong, Warren W. Buck, and Khin M. Maung *In* Alabama A & M Univ., NASA-HBCU Space Science and Engineering Research Forum Proceedings 1989 p 146-16 (For primary document see N91-28063 19-99)
Avail: NTIS HC/MF A23 CSCL 20H

N91-28094*# Howard Univ., Washington, DC. Dept. of Chemistry.
THE UV PHOTOCHEMISTRY OF C2N2
Joshua B. Halpern and Samuel A. Barts *In* Alabama A & M Univ., NASA-HBCU Space Science and Engineering Research Forum Proceedings 1989 p 231-23 Sponsored in part by Danforth Foundation Fellowship (For primary document see N91-28063 19-99)
(Grant NAG5-071)
Avail: NTIS HC/MF A23 CSCL 20H

N91-28114*# National Aeronautics and Space Administration. Langley Research Center, Hampton, VA.
PROGRESS IN PROTON TRANSPORT CODE DEVELOPMENT: MICROELECTRONIC APPLICATION
Duc M. Ngo, Warren W. Buck, Tom N. Fogarty (Hampton Univ., VA.), and J. W. Wilson *In* Alabama A & M Univ., NASA-HBCU Space Science and Engineering Research Forum Proceedings 1989 p 371-38 (For primary document see N91-28063 19-99)
Avail: NTIS HC/MF A23 CSCL 20H

73 NUCLEAR AND HIGH-ENERGY PHYSICS

Includes elementary and nuclear particles; and reactor theory.

For space radiation see *93 Space Radiation.*

N91-27938# Los Alamos National Lab., NM.
A PARALLEL NON-NEURAL TRIGGER TRACKER FOR THE SSC
R. M. Farber, W. Kennison, and A. S. Lapedes 1991 7 p Presented at the 1991 International Joint Conference on Neural Networks (IJCNN), Seattle, 8-12 Jul. 1991
(Contract W-7405-eng-36)
(DE91-008594; LA-UR-91-607; CONF-910779-5) Avail: NTIS HC/MF A02

The Superconducting Super Collider (SSC) is a major project promising to open the vistas of very high particle physics. When the SSC is in operation, data will be produced at a staggering rate. Current estimates place the raw data coming out of the proposed silicon detector system at 2.5 x 10(exp 16) bits/second. Clearly, storing all events for later off-line processing is totally impracticable. A hierarchy of triggers, firing only on events meeting increasingly specific criteria, are planned to cull interesting events from the flood of information. Each event consists of a sequence of isolated 'hits', caused by particles hitting various parts of the detector. Collating these hits into the tracks of the approximately 500 particles/event, and then quickly deciding which events meet the criteria for later processing, is essential if the SSC is to produce usable information. This paper addresses the need for real-time triggering and track reconstruction. A benchmarked and buildable algorithm, operable at the required data rates, is described. The use of neural nets, suggested by other researchers, is specifically avoided as unnecessary and impractical. Instead, a parallel algorithm, and associated hardware architecture using only conventional technology, is presented. The algorithm has been tested on fully scaled up, extensively detailed, simulated SSC

events, with extremely encouraging results. Preliminary hardware analysis indicate that the trigger/tracker may be built within proposed SSC budget guidelines. DOE

N91-27939*# New Mexico Univ., Albuquerque. Dept. of Chemical and Nuclear Engineering.
CONCEPTUAL STUDIES ON THE INTEGRATION OF A NUCLEAR REACTOR SYSTEM TO A MANNED ROVER FOR MARS MISSIONS Final Report, Feb. 1989 - Nov. 1990
Mohamed S. El-Genk and Nicholas J. Morley Jul. 1991 88 p
(Grant NAG3-992)
(NASA-CR-185841; NAS 1.26:185841) Avail: NTIS HC/MF A05 CSCL 18K

Multiyear civilian manned missions to explore the surface of Mars are thought by NASA to be possible early in the next century. Expeditions to Mars, as well as permanent bases, are envisioned to require enhanced piloted vehicles to conduct science and exploration activities. Piloted rovers, with 30 kWe user net power (for drilling, sampling and sample analysis, onboard computer and computer instrumentation, vehicle thermal management, and astronaut life support systems) in addition to mobility are being considered. The rover design, for this study, included a four car train type vehicle complete with a hybrid solar photovoltaic/regenerative fuel cell auxiliary power system (APS). This system was designed to power the primary control vehicle. The APS supplies life support power for four astronauts and a limited degree of mobility allowing the primary control vehicle to limp back to either a permanent base or an accent vehicle. The results showed that the APS described above, with a mass of 667 kg, was sufficient to provide live support power and a top speed of five km/h for 6 hours per day. It was also seen that the factors that had the largest effect on the APS mass were the life support power, the number of astronauts, and the PV cell efficiency. The topics covered include: (1) power system options; (2) rover layout and design; (3) parametric analysis of total mass and power requirements for a manned Mars rover; (4) radiation shield design; and (5) energy conversion systems. Author

N91-27940*# National Aeronautics and Space Administration, Washington, DC.
FUSION ENERGY FOR SPACE MISSIONS IN THE 21ST CENTURY: EXECUTIVE SUMMARY
Norman R. Schulze Washington Aug. 1991 54 p
(NASA-TM-4297; NAS 1.15:4297) Avail: NTIS HC/MF A04 CSCL 20H

Future space missions were hypothesized and analyzed, and the energy source of their accomplishment investigated. The missions included manned Mars, scientific outposts to and robotic sample return missions from the outer planets and asteroids, as well as fly-by and rendezvous missions with the Oort Cloud and the nearest star, Alpha Centauri. Space system parametric requirements and operational features were established. The energy means for accomplishing missions where delta v requirements range from 90 km/sec to 30,000 km/sec (High Energy Space Mission) were investigated. The need to develop a power space of this magnitude is a key issue to address if the U.S. civil space program is to continue to advance as mandated by the National Space Policy. Potential energy options which could provide the propulsion and electrical power system and operational requirements were reviewed and evaluated. Fusion energy was considered to be the preferred option and was analyzed in depth. Candidate fusion fuels were evaluated based upon the energy output and neutron flux. Additionally, fusion energy can offer significant safety, environmental, economic, and operational advantages. Reactors exhibiting a highly efficient use of magnetic fields for space use while at the same time offering efficient coupling to an exhaust propellant or to a direct energy convertor for efficient electrical production were examined. Near term approaches were identified. A strategy that will produce fusion powered vehicles as part of the space transportation infrastructure was developed. Space program resources must be directed toward this issue as a matter of the top policy priority. Author

N91-27941# Aerospace Corp., El Segundo, CA. Aerophysics Lab.
TIME-RESOLVED MASS AND ENERGY ANALYSIS
J. E. Pollard, D. A. Lichtin, S. W. Janson, and R. B. Cohen 8 Apr. 1991 43 p
(Contract F04701-88-C-0089)
(AD-A235938; TR-0089(4930-02)-1; SD-TR-91-11) Avail: NTIS HC/MF A03 CSCL 18/4

A new method for time resolved mass and kinetic energy analysis of ionic or neutral species in the range of 1 to 150 amu and 0.5 to 500 eV is described. Time of flight mass spectrometry is combined with position sensitive detection to measure energy spectra for multiple masses at burst mode sampling rates as high as 50 kHz. The detector is a rectangular microchannel plate with a 96 element metal anode array that is read out either by fast analog to digital converters or by discriminators and scalers. The apparatus is configured so that the measured ion drift time varies as the square root of the mass to charge ratio and the displacement along the detector varies as the square root of the energy to charge ratio. Applications are envisioned in plasma analysis, in beam scattering experiments, and in diagnostic measurements for spacecraft propulsion. GRA

N91-27968# Nagaoka Technological Univ., Niigata (Japan). Lab. of Beam Technology.
PULSE-POWER TECHNOLOGY AND ITS APPLICATIONS AT LBT, NAGAOKA
K. Yatsui, K. Masugata, Y. Sekimoto, W. Jiang, G. Imada, H. Okuda, S. Kobayashi, T. Komorida, K. Shimiya, and T. Sonegawa *In* National Inst. for Fusion Science, Proceedings of a Workshop on Emissions from Heavy Current Carrying High Density Plasma and Diagnostics May 1991 p 55-64 Sponsored in part by Ministry of Education, Science and Culture (For primary document see N91-27962 19-75)
Avail: NTIS HC/MF A06

74 OPTICS

Includes light phenomena; and optical devices.
For lasers see *36 Lasers and Masers.*

N91-27942# Alabama Univ., Huntsville. School of Engineering.
AERO-OPTICS ANALYSIS Annual Technical Report, 28 Sep. 1989 - 30 Sep. 1990
Lynn D. Russell Jan. 1991 82 p
(Contract DASG60-89-C-0145)
(AD-A234647; UAH01/A006) Avail: NTIS HC/MF A05 CSCL 16/2

The U.S. Army Strategic Defense Command (USASDC) has several ongoing and planned programs that utilize optical sensors aboard missiles traveling at hypersonic velocities in the atmosphere. Central to the missile homing problem are aero-optical effects upon a missile-borne sensor/seeker which looks through both an electromagnetic window and the flow field about the vehicle. Aspects of the problem include modeling and simulation of the flow field on incident radiation from a target, and finally, predicting the resultant image imperfections and error in apparent object position as perceived by the sensor. GRA

N91-27943 Department of the Navy, Washington, DC.
HIGH DEFINITION VIDEO-RATE LASER-ADDRESSED LIQUID-CRYSTAL LIGHT-VALVE PROJECTION DISPLAY Patent
John A. Trias, inventor (to Navy) 12 Feb. 1991 6 p Filed 24 May 1989
(AD-D014891; US-Patent-4,992,880; US-Patent-Appl-SN-359786; US-Patent-Class-358-236) Avail: US Patent and Trademark Office CSCL 14/2

A high definition, video-rate laser-addressed liquid-crystal light-valve projection display provides for real-time applications to large-area projection displays. A laser raster scanner uses acousto-optic components to modulate and deflect the laser beam.

An acoustic optical, acoustic traveling wave lens is included to increase the optical resolution of the scanner system. A liquid-crystal light-valve spatially is modulated by a high resolution coherent beam to responsibly modulate a high intensity light coming from an arc lamp source. The modulated high intensity light is reflected from the liquid-crystal light-valve and is projected onto a large screen. The use of acousto-optic Bragg cells to modulate, horizontally track, horizontally chirp and vertically impart a beam of coherent light allows a projection of a 1075-line RS-343A high definition or resolution TV standard image on the screen. GRA

N91-27944 Department of the Navy, Washington, DC.
VARIABLE WEIGHT FIBER OPTIC TRANSVERSAL FILTER Patent
Mark H. Berry, inventor (to Navy) and Debra M. Gookin, inventor (to Navy) 5 Mar. 1991 13 p Filed 26 Feb. 1990
(AD-D014893; US-Patent-4,997,249; US-Patent-Appl-SN-486622; US-Patent-Class-350-96.15) Avail: US Patent and Trademark Office CSCL 20/6

A transversal filter uses optical components to provide for a wide bandwidth, greater than 10 GHz signal processing capability. RF modulated optical signals are fed over different lengths of optical fibers to impart appropriate tap delays and each is coupled to an integrated optical coupler. Each of the integrated optical couplers have the capability to introduce variable positive and negative weights. Incoherent summing means receive the modulated signals and feed them to an interconnected detector to thereby provide appropriate positive and negative variable weighted signals. Author (GRA)

N91-27945# Oregon Univ., Eugene. Dept. of Physics.
EXPERIMENTAL STUDIES OF FUNDAMENTAL PROBLEMS IN QUANTUM OPTICS Final Technical Report, 1 Dec. 1987 - 31 Jan. 1991
Thomas W. Mossberg 15 Apr. 1991 73 p
(Grant AF-AFOSR-0086-88; AF Proj. 2301)
(AD-A235454; AFOSR-91-0494TR) Avail: NTIS HC/MF A04 CSCL 20/10

An extensive study of the dynamical properties of laser driven atoms in optical cavities has been completed. The presence of a cavity is found to produce behavior dramatically different from that exhibited by driven atoms in free space. In the case of mode-degenerate optical cavities, it is found that a laser field may drive two-level atoms into steady-state inversion. This has been considered impossible. Such cavities are also found to perturb fundamental strong-field atomic spectra. These perturbations indicate novel and previously unseen atomic dynamics. In as much as any small structure may produce effects similar to those produced by cavity, the results of the present experiments demonstrate that small optical devices may be operable in heretofore totally unanticipated regimes. We have also found that driven atoms in a cavity exhibit two-photon gain and may form the basis of the first CW two-photon laser. Already the first measurements of CW two-photon gain have been completed. We have theoretically analyzed the behavior of both one and two-photon driven atom lasers, and find that both may exhibit bright squeezing. In other words, these lasers have a squeezed-state output field rather than a coherent-state output. GRA

N91-27946# Rome Air Development Center, Griffiss AFB, NY.
OPTICAL PERFORMANCE ANALYSIS OF THE PRECISION OPTICAL RESEARCH AND TRACKING FACILITY (PORTF) Report, Oct. 1989 - Oct. 1990
Paul L. Repak Mar. 1991 111 p
(AD-A235604; RL-TR-91-47) Avail: NTIS HC/MF A06 CSCL 20/6

The Precision Optical Research and Tracking Facility (PORTF) is the field optical site operated by the Directorate of Surveillance at Rome Laboratory (RL/OC). This report discusses the optical configuration of PORTF and practical optical component set-up considerations. Results are documented from computer analyses which simulate the complete primary optical system. Common alignment errors in the optical train and focal plane were investigated with a goal of determining allowable tolerances in the optomechanical alignment of the components. The tolerance limits may be used as a baseline during telescope alignment exercises to determine the alignment accuracies needed to produce acceptable images. Author (GRA)

N91-27947# Rockwell International Corp., El Segundo, CA.
OPTICAL ANALYSIS OF AIRCRAFT TRANSPARENCIES (OPTRAN). VOLUME 1: THEORETICAL MANUAL Final Report, Dec. 1988 - May 1990
J. Loomis and J. Fielman Oct. 1990 62 p Prepared in cooperation with Dayton Univ. Research Inst., OH
(Contract F33615-86-C-3414)
(AD-A235931; UDR-TR-90-63-Vol-1; WRDC-TR-90-3058-Vol-1) Avail: NTIS HC/MF A04 CSCL 20/6

The theory is described of the Optical Transmission (OPTRAN) code developed to predict the optical performance of aircraft aircrew enclosure transparency designs subjected to operational loads. The theory on which the code is based is described. The OPTRAN ray trace code accounts for thermal and stress optical effects. Geometry is defined by parametric cubic solid. The refraction of incoming light is computed as a function of parametric solid surface outward normals. Angular deviation, polarization effects, and lensing are computed for each ray. GRA

N91-27948# Carnegie-Mellon Univ., Pittsburgh, PA. Center for Excellence in Optical Data Processing.
OPTICAL NEURAL NETS FOR SCENE ANALYSIS Final Report, Apr. 1990 - Mar. 1991
David Casasent Apr. 1991 86 p
(Contract DAAH01-89-C-0418; ARPA Order 6671)
(AD-A235955) Avail: NTIS HC/MF A05 CSCL 20/6

This project involves hybrid optical/digital neural nets (NNs) with attention to one of the most formidable NN problems: scene analysis and pattern recognition. Our research is unique in its attention to a hybrid optical/digital NN architecture that is very multifunctional. We describe the various novel uses for optics we employ within a NN and how our hybrid architecture can implement most major NNs (specifically: associative processors, optimization NNs, NNs to handle multiple objects in the field of view, and adaptive learning NNs). We also include new matrix inversion NN concepts. Our scene analysis algorithm work includes a new feature space, a new hybrid pattern recognition/neural net algorithm (the ACNNO, our symbolic correlator production system NN (that handles multiple objects in the field of view in parallel), and an advanced piecewise quadratic NN (PQNN) concept. Our major thrust has been the optical laboratory realization of these NN algorithms. Our initial work in this area is noted and includes: new error source modeling simulations of our initial and new real time optical laboratory system, a description of our newest optical laboratory system, and initial test results obtained with it. GRA

N91-27949# Calspan-Buffalo Univ. Research Center, NY.
LITHIUM NIOBATE ARITHMETIC LOGIC UNIT Final Report, Apr. 1989 - Aug. 1990
Andrew R. Pleszkun Mar. 1991 94 p Prepared in cooperation with Colorado Univ., Boulder
(Contract F30602-88-D-0026)
(AD-A236062; RL-TR-91-22) Avail: NTIS HC/MF A05 CSCL 20/6

Initial development of an optical-serial arithmetic unit is explored. The design is based on lithium niobate directional coupler devices as the optical switching elements. The devices can be interconnected by optical fiber to create logic functions with which digital optic systems may be constructed. Circuit designs for implementing bit-serial multipliers and dividers are presented. Experimental procedures for characterization of lithium niobate switch performance are described, and measurement of drive-electronics delay is addressed. GRA

N91-27950# Rockwell International Science Center, Thousand Oaks, CA.
STUDIES OF PHASE-CONJUGATE OPTICAL DEVICE CONCEPTS Final Report, 1 May 1988 - 30 Sep. 1990
William Christian, Ian McMichael, and Pochi Yeh Apr. 1991 127 p
(Contract N00014-88-C-0230)
(AD-A236075; RT-SC5544-FR) Avail: NTIS HC/MF A07 CSCL 20/6

We investigate various nonlinear optical phase conjugators and their application in optical devices. Several of the device concepts are demonstrated including phase conjugate fiber-optic gyros optical pattern classifiers. GRA

N91-27951# Kent Univ., Canterbury (England). Dept. of Physics.
OPTICAL FIBRE BASED FREQUENCY SHIFTERS PROJECT Final Report, 1 Jan. 1989 - 31 Dec. 1990
M. Berwick and D. A. Jackson 28 Jan. 1991 80 p
(Contract F49620-88-C-0123)
(AD-A236353; R/D-TR-91-06) Avail: NTIS HC/MF A05 CSCL 20/6

This report summarizes the research program to develop acousto-optic frequency shifters based on highly linearly birefringent optical fiber. The theory of operation, fabrication, and performance of devices utilizing either flexural or torsional acoustic waves is presented. Research directed towards a flexural acoustic wave fiber frequency shifter lead us to the conclusion that this technique is not suitable for the production of a high efficiency device. The research into torsional acoustic wave fiber frequency shifters has enabled the fabrication of devices with two different designs of a torsional acoustic wave generator: (1) a side-fibre design; and (2) an in-line acoustic horn design. The fiber frequency shifters constructed from these generators produce a shift in the optical frequency of about 3 MHz. A fiber frequency shifter constructed using the former design had a maximum optical power coupling efficiency of 6 percent with an electrical power of 780 mW applied to the transducer. Unfortunately, this design is rather fragile, hence a large proportion of research effort has been devoted to the design and fabrication of the more rugged in-line acoustic horns. The maximum optical power coupling efficiency achieved to date with this design of fiber frequency shifter is about 2.5 percent. GRA

N91-27952# Washington Univ., Seattle. Aerospace and Energetics Research Program.
OPTICAL PROPERTIES OF PLANE SHEAR LAYERS UNDER PERIODIC DISTURBANCES Final Technical Report, Jun. 1987 - Oct. 1990
Walter H. Christiansen 25 Feb. 1991 43 p
(Grant AF-AFOSR-0258-87; AF Proj. 2307)
(AD-A236514) Avail: NTIS HC/MF A03 CSCL 14/2

The optical properties of low-speed shear layers was investigated. This included a preliminary study of the basic fluid mechanics of shear layers in which the role of coherent eddies was deemed important. A low-speed wind tunnel was used in which parallel flows of different gases could be studied in a shear layer configuration. Additional provisions for movement of a splitter plate were incorporated into the design to affect the mixing process. Measurements have shown that coherent structure does have a profound effect on the optics of the system and that these effects can be markedly changed with forced perturbation of the splitter plate. Numerical analyses of the problem also confirms the potential of optical control of the shear flow. GRA

N91-27953# North Carolina Univ., Chapel Hill. Dept. of Computer Science.
A COMPUTATIONAL MODEL FOR THE STEREOSCOPIC OPTICS OF A HEAD-MOUNTED DISPLAY
Warren Robinett and Jannick P. Rolland Feb. 1991 2 p
(Contracts N00014-86-K-0680; DAEA18-90-C-0044)
(AD-A236705; TR91-009) Avail: NTIS HC/MF A01 CSCL 14/4

For stereoscopic photography or telepresence, orthostereoscopy occurs when the perceived size, shape, and relative position of objects in the three dimensional scene being viewed match those of the physical objects in front of the camera. In virtual Reality, the simulated scene has no physical counterpart, so orthostereoscopy must be defined in this case as constancy, as the head moves around, of the perceived size, shape and relative positions of the simulated objects. Achieving this constancy requires that the computational model used to generate the graphics match the physical geometry of the head mounted display being used. This geometry includes the optics used to image the displays and the placement of the displays with respect to the eyes. The model may fail to match the geometry because model parameters are difficult to measure accurately, or because the model itself is in error. Two common modeling errors are ignoring the distortion caused by the optics and ignoring the variation in interpupillary distance across different users. A computational model for the geometry of a head mounted display is presented, and the parameters of this model for the VPL EyePhone are calculated. GRA

N91-27954# National Inst. of Standards and Technology, Gaithersburg, MD.
CRITICAL ASSESSMENT OF OPTICAL PROPERTIES OF CVD DIAMOND FILMS Interim Report
Albert Feldman and Lawrence H. Robins 12 Apr. 1991 10 p
(Contract N00014-90-F-0011)
(AD-A236746; NIST-TR-3) Avail: NTIS HC/MF A02 CSCL 20/6

The basic phenomena that determine the optical properties of diamond, which include the electronic band structure, the phonon structure, and defects, are discussed. Experiments on chemical vapor deposited diamond relevant to its applications as an optical material are reviewed. The most immediate application is the diamond x ray window. Other applications, such as infrared transmissive elements and coatings, will require considerable improvement in material quality. Surface roughness is a major impediment. The ability to deposit smooth surfaces would make diamond considerably more attractive as optical material. Diamond also has promise as a blue luminescent or laser material. Identifying and controlling the relevant luminescent centers will be needed to improve the quantum efficiencies of such devices. GRA

N91-27955# Physical Optics Corp., Torrance, CA.
OPTICAL CACHE MEMORY Final Report, May 1989 - Jun. 1990
Chai-Pei Kuo Apr. 1991 64 p
(Contract F30602-89-C-0089)
(AD-A236794; RL-TR-91-40) Avail: NTIS HC/MF A04 CSCL 20/6

The goal of this effort is to build an Exploratory Development Model (EDM), of an optical cache memory utilizing existing off-the-shelf components to demonstrate system feasibility, key system concepts, and validation of the overall system approach. An optical parallel addressing architecture was identified which utilizes a vector-matrix inner product as the basic frame work for an optical cache memory system. Furthermore, in order to mimic the dynamic memory requisition and updating sequence that is encountered in an electronic system, a polymeric memory material was studied and its performance was tailored to provide long memory persistence, fast writing, fast erasing, and high efficiency. GRA

N91-27956*# Sam Houston State Univ., Huntsville, TX. Dept. of Physics.
OPTICAL AND ELECTRICAL PROPERTIES OF THIN SUPERCONDUCTING FILMS Final Report, 1 Jun. - 31 Dec. 1990
Billy C. Covington and Feng Chen Jing 31 Dec. 1990 49 p
(Grant NAG5-1347)
(NASA-CR-188668; NAS 1.26:188668) Avail: NTIS HC/MF A03 CSCL 20F

Infrared spectroscopic techniques can provide a vital probe of

the superconducting energy gap which is one of the most fundamental physical properties of superconductors. Currently, the central questions regarding the optical properties of superconductors are how the energy gap can be measured by infrared techniques and at which frequency the gap exists. An effective infrared spectroscopic method to investigate the superconducting energy gap, Eg, was developed by using the Bomem DA 3.01 Fourier Transformation Spectrophotometer. The reflectivity of a superconducting thin film of YBaCuO deposited on SrTiO3 was measured. A shoulder was observed in the superconducting state reflectance R(sub S) at 480/cm. This gives a value of Eg/kT(sub c) = 7.83, where k is the Boltzmann constant and T(sub c) is the superconducting transition temperature, from which, it is suggested that YBaCuO is a very strong coupling superconductor. Author

N91-27957* National Aeronautics and Space Administration. Pasadena Office, CA.
FIBER OPTIC FREQUENCY TRANSFER LINK Patent
Lori E. Primas, inventor (to NASA), Richard L. Sydnor, inventor (to NASA), and George F. Lutes, inventor (to NASA) (Jet Propulsion Lab., California Inst. of Tech., Pasadena.) 9 Jul. 1991 22 p Filed 31 May 1989
(Contract NAS7-918)
(NASA-Case-NPO-17703-1-CU; US-Patent-5,031,234; US-Patent-Appl-SN-359801; US-Patent-Class-455-605; US-Patent-Class-356-5; Int-Patent-Class-H04B-10/00) Avail: US Patent and Trademark Office CSCL 20F

A reference frequency distribution system is disclosed for transmitting a reference frequency from a reference unit to a remote unit while keeping the reference frequency at the reference unit and the remote unit in phase. A fiber optic cable connects the reference unit to the remote unit. A frequency source at the reference unit produces a reference frequency having an adjustable phase. A fiber optic transmitter at the reference unit modulates a light beam with the reference frequency and transmits the light beam into the fiber optic cable. A 50/50 reflector at the remote unit reflects a first portion of the light beam from the reference unit back into the fiber optic cable to the reference unit. A first fiber optic receiver disposed at the remote unit receives a second portion of the light beam and demodulates the reference frequency to be used at the remote unit. A second fiber optic receiver disposed at the reference unit receives the first portion of the light beam and demodulates a reference frequency component. A phase conjugator is connected to the frequency source for comparing the phase of the reference frequency component to the phase of the reference frequency modulating the light beam being transmitted from the reference unit to maintain a conjugate (anti-symmetric) relationship between the reference frequency component and the reference frequency modulating the light beam where virtually no phase difference exists between the phase of the reference frequency component and the phase of the reference frequency modulating the light beam.
Official Gazette of the U.S. Patent and Trademark Office

N91-28126*# Alabama A & M Univ., Normal. Dept. of Physics.
SURFACE ROUGHNESS OF FLAT AND CURVED OPTICAL SURFACES
M. C. George, Bandi Jagannadha Reddy, H. Jagannath, M. Perera, and P. Venkateswarlu *In* Alabama A & M Univ., NASA-HBCU Space Science and Engineering Research Forum Proceedings 1989 p 482-48 (For primary document see N91-28063 19-99)
(Grant NAG8-29)
Avail: NTIS HC/MF A23 CSCL 20F

75 PLASMA PHYSICS

Includes magnetohydrodynamics and plasma fusion.
For ionospheric plasmas see *46 Geophysics*. For space plasmas see *90 Astrophysics*.

N91-27958# National Inst. for Fusion Science, Nagoya (Japan).
EFFECT OF ENERGETIC PARTICLE DISTRIBUTION ON BOUNCE RESONANCE EXCITATION OF THE IDEAL BALLOONING MODE
Tomejiro Yamagishi (Fukui Inst. of Tech., Japan) Feb. 1991 29 p
(NIFS-75; ISSN-0915-633X) Avail: NTIS HC/MF A03

The kinetic effect of energetic trapped particles on the stability of magnetohydrodynamic (MHD) ballooning mode is studied in a tokamak with the circular cross section. The bounce resonance contribution of trapped energetic particles is found to play an important role in the outer inertial region of the ballooning mode perturbation, and destabilizes the ballooning mode when the shear effect is not strong. The inhomogeniety of a model slowing down energetic particle distribution in velocity space, deltaF/deltaE, is effective to stabilize the bounce resonant mode. Author

N91-27959# Edgerton, Germeshausen and Grier, Inc., Idaho Falls, ID.
MEASUREMENT OF THERMAL PLASMA JET TEMPERATURE AND VELOCITY BY LASER LIGHT LINESHAPE ANALYSIS
S. C. Snyder and L. D. Reynolds 1991 3 p Presented at the 20th International Conference on Phenomena in Ionized Gases, Barga (Italy), 8-12 Jul. 1991
(Contract DE-AC07-76ID-01570)
(DE91-010053; EGG-M-91017; CONF-910711-1) Avail: NTIS HC/MF A01

Two important parameters of thermal plasma jets are kinetic or gas temperatures and flow velocity. Gas temperatures have been traditionally measured using emission spectroscopy, but this method depends on either the generally unrealistic assumption of the existence of local thermodynamic equilibrium (LTE) within the plasma, or the use of various non-LTE or partial LTE models to relate the intensity of the emission lines to the gas temperature. Plasma jet velocities have been measured using laser Doppler velocimetry on particles injected into the plasma. However, this method is intrusive and it is not known how well the particle velocities represent the gas velocity. Recently, plasma jet velocities have been measured from the Doppler shift of laser light scattered by the plasma. In this case, the Doppler shift was determined from the difference in the transmission profile of a high resolution monochromator between red shifted and blue shifted scattered light. A direct approach to measuring localized temperatures and velocities is afforded by high resolution scattered light lineshape measurements. The linewidth of laser light scattered by atoms and ions can be related to the kinetic temperature without LTE assumptions, while a shift in the peak position relative to the incident laser lineshape yields the gas velocity. We report in this paper work underway to measure gas temperatures and velocities in an argon thermal plasma jet using high resolution lineshape analysis of scattered laser light. DOE

N91-27960# Lawrence Livermore National Lab., CA.
PRODUCTION OF COLD HIGHLY-IONIZED PLASMAS BY INTENSE SUBPICOSECOND LASERS
B. M. Penetrante and J. N. Bardsley 1 Feb. 1991 4 p Presented at the 20th International Conference on Phenomena in Ionized Gases, Barga (Italy), 8-12 Jul. 1991
(Contract W-7405-eng-48)
(DE91-010461; UCRL-JC-106472; CONF-910711-5) Avail: NTIS HC/MF A01

Recent advances in high-intensity ultrashort-pulse lasers has made feasible the implementation of the transient recombination scheme for producing x ray lasing in optical-field-ionized plasmas. This scheme involves plasmas consisting of fully stripped ions (or helium-like ions) and cold electrons. Immediately after the pump laser pulse, inversion occurs in hydrogen-like ions (or lithium-like ions) during the initial cascade of population through the excited

levels of the ion. The gain duration is of the order of the radiative lifetime of the lasing transition, which is short compared with the recombination time. The major advantage of this approach is the ability to access very short wavelength resonance lines with high efficiency at achievable pump intensities. Moreover, this approach provides an ideal way of preparing the target medium for producing gain later in time on the type of transitions encountered in traditional rapidly cooled recombination lasers. There are two conditions that must be satisfied in order to produce gain using ultrashort-pulse lasers. The first condition is that the target media must be ionized to the fully stripped state (or to the helium-like state to implement lithium-like recombination schemes). The second condition is the residual electron energy produced immediately after the pump laser pulse must be low enough so that the system is far from ionization equilibrium and strong three-body recombination commences immediately. The first purpose of this paper is to show the laser intensity requirements for producing optical-field-ionized plasmas which are of interest to x ray lasing. The second purpose of this paper is to show what residual electron energies will be produced at the minimum required pump laser intensities. DOE

N91-27961*# Iowa Univ., Iowa City. Dept. of Physics and Astronomy.
INTERPRETATION OF PLASMA DIAGNOSTICS PACKAGE RESULTS IN TERMS OF LARGE SPACE STRUCTURE PLASMA INTERACTIONS Final Technical Report, 10 Jul. 1983 - 1 Aug. 1991
William S. Kurth 1 Aug. 1991 942 p
(Grant NAG3-449)
(NASA-CR-188651; NAS 1.26:188651) Avail: NTIS HC/MF A99 CSCL 20I

The Plasma Diagnostics Package (PDP) is a spacecraft which was designed and built at The University of Iowa and which contained several scientific instruments. These instruments were used for measuring Space Shuttle Orbiter environmental parameters and plasma parameters. The PDP flew on two Space Shuttle flights. The first flight of the PDP was on Space Shuttle Mission STS-3 and was a part of the NASA/Office of Space Science payload (OSS-1). The second flight of the PDP was on Space Shuttle Mission STS/51F and was a part of Spacelab 2. The interpretation of both the OSS-1 and Spacelab 2 PDP results in terms of large space structure plasma interactions is emphasized. Author

N91-27962# National Inst. for Fusion Science, Nagoya (Japan).
PROCEEDINGS OF A WORKSHOP ON EMISSIONS FROM HEAVY CURRENT CARRYING HIGH DENSITY PLASMA AND DIAGNOSTICS
Katsumi Hirano, ed. May 1991 108 p Workshop held in Nagoya, Japan, 5-6 Dec. 1990
(NIFS-Proc-7; ISSN-0915-6348) Avail: NTIS HC/MF A06

The largest group of papers was on soft x ray, ion, and electron beam emission. These topics are of foremost interest for groups which engage in research of the pulse power generator, the Z pinch, and the plasma focus. A variety of problems in pinched dense plasmas, namely spectroscopy, diagnostics, pinch dynamics, and related engineering aspects were also discussed. For individual titles, see N91-27963 through N91-27972.

N91-27963# Yamanashi Univ., Kofu (Japan). Dept. of Electrical Engineering and Computer Science.
A SPECTROSCOPIC STUDY OF A PLASMA LIGHT SOURCE EXCITED BY A DOUBLE BLUMLEIN PULSE FORMING NETWORK
Ken Satoh and Tetsuya Akitsu *In* National Inst. for Fusion Science, Proceedings of a Workshop on Emissions from Heavy Current Carrying High Density Plasma and Diagnostics May 1991 p 1-10 (For primary document see N91-27962 19-75)
Avail: NTIS HC/MF A06

A combination of a coaxial electrode and double Blumlein PFN (pulse forming network) produced relatively high density plasma despite the simplicity of the experimental apparatus. Double Blumlein PFN has a capacity of -21 kV, 5.6 kA pulse output with 500 ns pulse width. The electric circuit was simulated by the use of an analog circuit simulator Micro Cap 3, and uncertain circuit parameters and its dependence to the circuit parameter were clarified. Spectroscopic study of He I (388.9, 586.6, and 447.1-446.9 nm), F-A pair, and He II (468.6 nm) were performed and some of the plasma parameters were measured in good agreement with each other. Typical temperature and density are 4.9 eV, 1 x 10(exp 17)/cu cm. The ratio of the kinetic energy stored in the plasma to input energy was computed. The efficient plasma production with rather high temperature and density was achieved by the compact PFN discharge. Author

N91-27964# Tokyo Inst. of Tech. (Japan).
SOFT X RAY EMISSION AND DIAGNOSIS FROM FIBER PINCH AND CONDUCTIVE THIN FILM LINER COMPRESSION PLASMA
Yoshikazu Hoshina, Mamoru Kanou, Satoshi Ogura, Kazuhiko Horioka, Kouichi Kasuya, Teruhiko Tajima (National Inst. for Fusion Science, Nagoya, Japan), and Shozo Ishii *In* National Inst. for Fusion Science, Proceedings of a Workshop on Emissions from Heavy Current Carrying High Density Plasma and Diagnostics May 1991 p 11-20 (For primary document see N91-27962 19-75)
Avail: NTIS HC/MF A06

Dense and high energy density Z-pinch plasmas are created by two different ways and are examined experimentally. A stable plasma column was created in a carbon fiber pinch driven by a pulsed power generator. Conductive thin film liner compression is proposed to overcome the disadvantages of metallic liner compression and gas pull Z-pinch. The dense Z-pinch plasmas are well diagnosed by x ray measurements. X ray diodes are used to obtain time-resolved x ray spectrum. Author

N91-27965# Gunma Univ., Maebashi (Japan). Dept. of Electronic Engineering.
TIME RESOLVED ELECTRON SPECTRUM ANALYZER c35
Katsumi Hirano, Toshikazu Yamamoto, Kouji Asami, and Makoto Shindo *In* National Inst. for Fusion Science, Proceedings of a Workshop on Emissions from Heavy Current Carrying High Density Plasma and Diagnostics May 1991 p 21-39 (For primary document see N91-27962 19-75)
Avail: NTIS HC/MF A06

An electron energy analyzer is designed for a time resolved measurement of pulsed energetic electron beams whose energy is in the range from 200 keV to several MeV, and successfully used to obtain energy distribution of the electron beam generated by a plasma focus device. The beam detection system is based on the Cerenkov effect. The electrons are injected into an optical medium to generate the Cerenkov radiation. The radiation is detected by six photomultipliers through optical fibers at different angles which depend on the electron energy. For the optical medium lucite is employed. Energy resolution of the detector is presented as a function of the electron energy. Author

N91-27966# Nagoya Univ. (Japan). Dept. of Electrical Engineering.
ENERGY CONVERTER FROM LASER ENERGY TO ELECTRICITY USING PLASMA AS A MEDIUM: THE SEPARATION OF IONS BY THE MEDIUM
Yoshihiko Kato, Kenichi Sato, Keiji Nakamura, Chobei Yamabe, and Kenji Horii (Toyota Coll. of Technology, Japan) *In* National Inst. for Fusion Science, Proceedings of a Workshop on Emissions from Heavy Current Carrying High Density Plasma and Diagnostics May 1991 p 40-45 (For primary document see N91-27962 19-75)
Avail: NTIS HC/MF A06

In a energy converter from laser energy to electricity converter, using plasma as a medium, the influence of the mesh coarseness in the converter and the increase in the conversion efficiency from the plasma's kinetic energy to electricity using the plural ion collector system are reported. B.G.

N91-27967# Nagoya Univ. (Japan). Dept. of Electrical Engineering.
CHARACTERISTICS OF CORONA-PREIONIZED UV TEA LASER **c36**
Takeshi Yasuda, Takamitsu Suzuki, Keiji Nakamura, Chobei Yamabe, and Kenji Horii (Toyota Coll. of Technology, Japan) *In* National Inst. for Fusion Science, Proceedings of a Workshop on Emissions from Heavy Current Carrying High Density Plasma and Diagnostics May 1991 p 46-54 (For primary document see N91-27962 19-75)
Avail: NTIS HC/MF A06

Corona-preionized ultraviolet TEA lasers were examined; TEA-N2 laser and KrF excimer laser. Capacitance Cs, which is related to preionization, is optimized. The value of the Cs should be determined to consider both the uniformity of discharge and the decrease in breakdown voltage. The laser power in the N2 laser is saturated at about E/P = 11.5 V/cm/Torr. In the KrF laser, the laser power is increased with increasing total pressure of the laser gas mixture and has the maximum value at F2/He is nearly equal or approximately 2/40 Torr. Author

N91-27968# Nagaoka Technological Univ., Niigata (Japan). Lab. of Beam Technology.
PULSE-POWER TECHNOLOGY AND ITS APPLICATIONS AT LBT, NAGAOKA **c73**
K. Yatsui, K. Masugata, Y. Sekimoto, W. Jiang, G. Imada, H. Okuda, S. Kobayashi, T. Komorida, K. Shimiya, and T. Sonegawa *In* National Inst. for Fusion Science, Proceedings of a Workshop on Emissions from Heavy Current Carrying High Density Plasma and Diagnostics May 1991 p 55-64 Sponsored in part by Ministry of Education, Science and Culture (For primary document see N91-27962 19-75)
Avail: NTIS HC/MF A06

An overview is presented on recent progress of pulse-power technology and its applications at the Laboratory of Beam Technology, Nagaoka University of Technology. Even in a very short time, extremely high power density will be achieved, which significantly differs from a normal state. In fact, various applications can be available in a wide area. It includes research and development in (1) inertial confinement fusion, (2) applications in material science, and (3) applications in laser engineering. Author

N91-27969# Himeji Inst. of Tech. (Japan). Dept. of Electrical Engineering.
CHARACTERISTICS OF ION BEAM GENERATED WITH THE 'POINT PINCH DIODE'
M. Sato, S. Tokimasa, M. Yatsuzuka, S. Nobuhara, and T. Tazima (National Inst. for Fusion Science, Nagoya, Japan) *In* National Inst. for Fusion Science, Proceedings of a Workshop on Emissions from Heavy Current Carrying High Density Plasma and Diagnostics May 1991 p 65-74 (For primary document see N91-27962 19-75)
Avail: NTIS HC/MF A06

The characteristics of the ion beams generated with the Point Pinch Diode were investigated and copper ions were detected with the Thomson-parabola ion spectrometer. From time of flight measurement for the ions beams, the ratio of number densities between the proton H(+) and the copper ion in the fourth state of ionization Cu(4+) was evaluated. The result shows that the number density of Cu(4+) typically corresponds to a half of that of H(+). Author

N91-27970# Kumamoto Univ. (Japan).
SOFT X RAY EMISSION FROM A GAS-PUFF Z-PINCH PLASMA
S. Ueda, S. Maeda, and H. Akiyama *In* National Inst. for Fusion Science, Proceedings of a Workshop on Emissions from Heavy Current Carrying High Density Plasma and Diagnostics May 1991 p 75-81 (For primary document see N91-27962 19-75)
Avail: NTIS HC/MF A06

Soft x ray emission or radiation was studied by using a gas-puff z-pinch device, which has no triggered switch. A PIN-photodiode covered by aluminum was used for the detection of soft x rays. Three kinds of spatial emission patterns were observed from measurement using a pinhole camera. Hot spots were observed near the middle of the discharge. In order to determine the pressure of the gas during the discharge, a simulation of a gas-puff z-pinch plasma was done with the snow plow model. The gas pressure is supposed as approximately 1 Torr. Author

N91-27971# Niigata Univ. (Japan). Atomic Energy Research Inst.
X RAY RADIATION FROM A GAS-PUFF Z-PINCH PLASMA
K. Takasugi, A. Takeuchi, H. Takada, M. Kimura, and T. Miyamoto *In* National Inst. for Fusion Science, Proceedings of a Workshop on Emissions from Heavy Current Carrying High Density Plasma and Diagnostics May 1991 p 82-91 (For primary document see N91-27962 19-75)
Avail: NTIS HC/MF A06

A z-pinch experiment was performed with a hollow-shaped Ar gas-puff. Three types of discharge were found depending on the delay time of discharge from gas-puff detection. Strong x ray radiations were emitted from spots, a volume with cloud structure and the anode surface. The number of x ray spikes observed in a scintillation probe signal is correlated with spot images of an x ray photograph. X ray bursts are sometimes observed. Energy analysis of the x ray pictures show that the x ray emission taken in the picture is concentrated in the energy range 8 to 10 keV. Although the emission from the bulk plasma is not involved in this range, materials evaporated from the electrode are considered to play an important role on the x ray radiation, then the dynamics of the z-pinch itself. Author

N91-27972# Tohoku Univ., Sendai (Japan). Inst. for Materials Research.
DEVELOPMENT OF WIRE AND COIL DESIGNING FOR HIGH-MAGNETIC FIELD GENERATION **c33**
Giyuu Kido *In* National Inst. for Fusion Science, Proceedings of a Workshop on Emissions from Heavy Current Carrying High Density Plasma and Diagnostics May 1991 p 92-101 (For primary document see N91-27962 19-75)
Avail: NTIS HC/MF A06

The ultimate tensile strength, and electric conductivity were investigated for Cu(Nb), Cu(Be), Cu(Cr), Cu(Ag), and Cu(Nb-Ti) wires in order to produce higher magnetic field than 50 T. The highest tensile strength is realized in Cu(Nb) wire. The Cu(Nb) and Cu(Ag) are regarded as the best materials for the nondestructive pulsed-magnetic-field generation. The coil designing was also studied to generate high magnetic field. It was found that the fiberglass reinforcement of wire layer by layer is quite effective to produce high pulsed magnetic fields. By using this technique, a 55 T field can be generated even using pure copper wire. The usage of water (ice) for solidifying the solenoid shortens considerably the cooling time of the pulsed magnet. Author

N91-27973# SRI International Corp., Menlo Park, CA.
CALCULATIONS OF ELECTRON ATTACHMENT AND RECOMBINATION IN A HYDROGEN PLASMA Final Report, 15 Feb. 1988 - 14 Feb. 1991
A. P. Hickman Feb. 1991 90 p
(Contract F49620-88-K-0005)
(AD-A235522; AFOSR-91-0886TR) Avail: NTIS HC/MF A05
CSCL 20/9

This project involved theoretical calculations of microscopic atomic and molecular processes in the generation of H(-) in a hydrogen plasma. Efficient production of H(-) is essential for practical applications such as particle beams and fusion plasmas. The specific objectives of the project were: (1) to calculate cross sections foe dissociative recombination of electrons with H2(+) (2) to provide theoretical analysis for ongoing experiments that use multiphoton ionization to investigate the spectroscopy of excited states of molecular hydrogen, and (3) to calculate cross sections for dissociative attachment of electrons with vibrationally excited hydrogen molecules. GRA

N91-27974# Naval Research Lab., Washington, DC.
REDUCTION OF THREE-HALVES HARMONIC EMISSION FROM LASER-PRODUCED PLASMAS WITH BROADWIDTH INDUCED SPATIAL INCOHERENCE AT 0.53 MICROMETERS Memorandum Report
T. A. Peyser, C. K. Manka, S. P. Obenschain, and K. J. Kearney 24 May 1991 27 p
(AD-A235798; NRL-MR-6798; DE91-012150) Avail: NTIS HC/MF A03 CSCL 20/9

Measurements of the omega sub 0/2 emission from Laser irradiated targets at 0.53 microns were made at three angles over a wide range of Laser bandwidths with and without induced spatial incoherence (ISI) echelons. THe 3 microns/2 emission was found to be correlated with hard x rays but not Raman spectra suggesting that the 3 omega sub 0/2 radiation was due to two plasmon decay. Reduction of both 3 omega sub 0/2 emission and the accompanying hard x rays by ISI required five to ten times Larger bandwidths than needed to suppress stimulated Raman scattering and stimulated Brilloin scattering. GRA

N91-27975# Georgia Inst. of Tech., Atlanta. Fusion Research Center.
A REVIEW OF MOMENTUM CONFINEMENT IN TOKAMAK PLASMAS
Gabriella Pautasso and Weston M. Stacey Jan. 1991 85 p
(Contract DE-FG05-87ER-51112)
(PB91-164087; GTFR-95) Avail: NTIS HC/MF A05 CSCL 20I

The paper reviews the theoretical and experimental work on momentum transport in tokamaks and summarizes the analysis of rotation measurements that were carried out on several devices. The experimental and theoretical evidence supporting poloidal variations of density and toroidal velocity, which are important parameters in neoclassical momentum transport theories, are also reviewed. Suggestions for further analysis and theoretical work are given. GRA

76 SOLID-STATE PHYSICS

Includes superconductivity.

For related information, see also *33 Electronics and Electrical Engineering* and *36 Lasers and Masers.*

N91-27976# Utah Univ., Salt Lake City. Dept. of Chemistry.
DISCREPANCIES IN THE CRYSTAL STRUCTURES ASSIGNED TO PRECIPITATED ZIRCONIA Technical Report, Jun. 1990 - May 1991
R. Srinivasan, S. F. Simpson, J. M. Harris, and B. H. Davis 22 Apr. 1991 5 p Prepared in cooperation with Kentucky Univ., Lexington
(Contract N00014-89-J-1412)
(AD-A234644; TR-22-ONR) Avail: NTIS HC/MF A01 CSCL 20/2

The prevailing discrepancies in the assignment of crystal structures in zirconia precipitated at pH of 13.5 were addressed. Higher-angle XRD line splittings of (006) and (600) indicate that the pH 13.5 material is tetragonal. Additional evidence was obtained from Raman spectroscopy to indicate that this material possesses tetragonal symmetry, not the cubic structure. The data clearly shows that the precipitation of zirconyl salts using NaOH at a pH of 13.5 results in the formation of tetragonal phase whether the washing is limited or extensive. It does not appear that conclusive proof is available to show that the presence of about 3 wt pct. Na can stabilize the metastable cubic phase at low temperatures. The conclusions of 14.15 need to be supported by data from other characterization techniques. GRA

N91-27977# Sandia National Labs., Albuquerque, NM.
THE 1/F NOISE IN n- AND p-CHANNEL MOS DEVICES THROUGH IRRADIATION AND ANNEALING
T. L. Meisenheimer, D. M. Fleetwood, and M. R. Shaneyfelt 1991 5 p Presented at the IEEE Annual International Nuclear and Space Radiation Effects Conference, San Diego, 15-19 Jul. 1991
(Contract DE-AC04-76DP-00789)
(DE91-008176; SAND-91-0447C; CONF-910751-2) Avail: NTIS HC/MF A01

The 1/f noise in irradiated n- and p-channel MOS transistors is shown to differ in magnitude, and in response to biased annealing. Possible origins of these differences are discussed. DOE

N91-27978# Sandia National Labs., Albuquerque, NM.
EFFECT OF BIAS ON THERMALLY STIMULATED CURRENT (TSC) IN IRRADIATED MOS DEVICES
D. M. Fleetwood, R. A. Reber, and P. S. Winokur 1991 5 p Presented at the IEEE Annual International Nuclear and Space Radiation Effects Conference, San Diego, 15-19 Jul. 1991
(Contract DE-AC04-76DP-00789)
(DE91-008179; SAND-91-0421C; CONF-910751-3) Avail: NTIS HC/MF A01

Thermally stimulated current (TSC) measurements at varying bias provide significant insight into the density, energy distribution, and location of MOS oxide-trap charge. Under proper bias conditions, TSC and C-V estimates of oxide-trap charge density agree well. DOE

N91-27979# Ames Lab., IA.
CHARACTERIZATIONS OF F-SUPERCONDUCTORS AND SELECTED F-COMPOUNDS, AMORPHOUS CARBON, AND (VO)2P2O7 BY F-19, C-13, H-1, AND P-31 NMR, AND A NEW PROBE FOR MULTIPLE PULSE, MAS, AND DAS NMR Ph.D. Thesis
Hongjun Pan 3 Apr. 1991 109 p
(Contract W-7405-eng-82)
(DE91-010566; IS-T-1546) Avail: NTIS HC/MF A06

NMR signals of F-19 were measured in the polycrystalline inorganic conductor Ag2F and in the polycrystalline insulators AgF, YOF, EuOF, YF3, CuF2, BaF2, and KF to compare them to the signals found in the so-called 1-2-3-type compounds with claimed formulas RBa2Cu3O(7-x)F(x) (R = Y and Eu). No evidence for a Knight-shifted, built-in fluorine-signal was found in the 1-2-3-type superconductors. The only signal found was from the BaF2 which is an impurity in the superconductors. DOE

N91-27980# Argonne National Lab., IL.
COMMON THREADS IN IMAGING AND PHOTOCATALYSIS: SILVER, SILVER HALIDES, AND SEMICONDUCTORS
D. Meisel 1991 5 p Presented at the 44th Annual Conference of the Imaging Science and Technology, St. Paul, 12-17 May 1991
(Contract W-31-109-eng-38)
(DE91-010626; ANL/CP-71884; CONF-9105127-2) Avail: NTIS HC/MF A01

Obvious common principles can be identified in imaging and in photocatalytic research. Initiation of chemical processes by absorption of photons, energy and electron transfer steps that follow the absorption of light, multi-electron events in a single confined microstructure, thermal degradation of the photon energy are but few of the principles studied in both fields. It is, therefore, to be expected that similar techniques and similar chemical systems will be investigated from these two points of view. In the present overview observations are discussed from photochemical and radiation chemical studies which were originally directed towards the photocatalytic field but might as well be of interest to the imaging community. DOE

N91-27981*# Clemson Univ., SC. Dept. of Ceramic Engineering.
ENVIRONMENTAL TEST PROGRAM FOR SUPERCONDUCTING MATERIALS AND DEVICES Mid-Term Report, May 1990 - Jun. 1991
Gene Haertling, Henry Randolph, Chi-Shiung Hsi, and Darren Verbelyi 26 Jul. 1991 73 p
(Grant NAG1-1127)

(NASA-CR-188654; NAS 1.26:188654) Avail: NTIS HC/MF A04 CSCL 20L

This report is divided into two parts. The first dealing with work involved with Clemson University and the second with the results from Westinghouse/Savannah River. Both areas of work involved low noise, low thermal conductivity superconducting grounding links used in the NASA-sponsored Spectroscopy of the Atmosphere using Far Infrared Emission (SAFIRE) Project. Clemson prepared the links from YBa2Cu3O(7-x) superconductor tape that was mounted on a printed circuit board and encapsulated with epoxy resin. The Clemson program includes temperature vs. resistance, liquid nitrogen immersion, water immersion, thermal cycling, humidity, and radiation testing. The evaluation of the links under a long term environmental test program is described. The Savannah River program includes gamma irradiation, vibration, and long-term evaluation. The progress made in these evaluations is discussed. K.S.

N91-27982# State Univ. of New York, Buffalo. Dept. of Chemistry.

(TERTIARY-BUTYL) CYCLOPENTADIENYLINDIUM(I), In(C5H4CMe3)-SYNTHESIS, CHARACTERIZATION, AND X RAY STRUCTURAL STUDY

O. T. Beachley, Jr., J. F. Lees, and Robin D. Rogers 14 May 1991 19 p

(Contract N00014-90-J-1530)

(AD-A235576; UBUFFALO/DC/91/TR-27) Avail: NTIS HC/MF A03 CSCL 14/2

The indium(I) compound, In(C5H4CMe3), has been prepared from the corresponding lithium cyclopentadienyl reagent Li(C5H4CMe3) and InCl in OEt2. Characterization data have included partial elemental analyses (C,H), physical properties, IR, H-1 NMR and mass spectroscopic data, oxidation reactions with dilute aqueous HCl and a single-crystal X-ray structural study. The colorless crystal of In(C5H4CMe3) consists of infinite zigzag chains. There are no interstrand In...In interactions. GRA

N91-27983# North Carolina State Univ., Raleigh.

GROWTH, CHARACTERIZATION, AND DEVICE DEVELOPMENT IN MONOCRYSTALLINE DIAMOND FILMS

Quarterly Letter Report, 1 Jan. - 31 Mar. 1991

Robert F. Davis Mar. 1991 31 p

(Contract N00014-90-J-1604)

(AD-A235731) Avail: NTIS HC/MF A03 CSCL 20/12

Externally mounted laser reflection interferometry has been incorporated into the microwave plasma growth process in order to follow the incubation period on Silicon (100) substrates and to measure the growth rate of the diamond films. Using biasing of the substrates eliminated the need for predeposition surface roughening and a much more controlled pretreatment via ion bombardment within the growth chamber. The nucleation density was varied by changing either the time of pretreatment or by varying the bias voltage. Diamond-like C films were prepared using rf sputtering of a pyrolytic graphite target. Elastic recoil experiments showed the films to contain from 23 to 33 percent H. These will be used in the future for moderate-high pressure experiments to see if the films will revert to diamond. Finally a modified Haynes-Shockley experiment was investigated as a technique for measuring the mobile charge transport character of diamond. A preliminary model has been derived and used to investigate dimensional, doping and time detection limits. Initial results are encouraging. GRA

N91-27984# Case Western Reserve Univ., Cleveland, OH. Dept. of Macromolecular Science.

SYNTHESIS AND CHARACTERIZATION OF POLY(METHYLSILOXANE)S CONTAINING 4-(S(-)-2-METHYL-1-BUTOXY) 4'-(P-(OMEGA-ALKAN-1-YLOXY)BENZOYLOXY) ALPHA-METHYLSTILBENE SIDE GROUPS

Virgil Percec and C. S. Wang 10 Apr. 1991 37 p

(Contract N00014-90-J-1828)

(AD-A235786; TR-46) Avail: NTIS HC/MF A03 CSCL 20/2

Previous publications from this lab reported the synthesis and characterization of polymethacrylates, polyacrylates and poly(methylsiloxane)s containing 4-S(-)-2 methyl 1-(butoxy) 4'(w-alkan-1-yloxy) a-methylstilbene side groups, in which the alkanyl group contains two to eleven methylenic units. Although in the field of low molar mass liquid crystals there are some empirical rules which are used to design compounds displaying chiral smectic C (sC*) mesophases, such rules are not available for side chain liquid crystalline polymers. A classic example comes from repeated attempts to synthesize side chain liquid crystalline polymers exhibiting a sC* mesophase led to polymers exhibiting a sA mesophase. Therefore, it was decided to perform a series of systematic investigations aimed to derive some empirical rules useful for the molecular design of side chain liquid crystalline polymers exhibiting sC* mesophases. GRA

N91-27985# Case Western Reserve Univ., Cleveland, OH. Dept. of Macromolecular Science.

SYNTHESIS AND CHARACTERIZATION OF POLY(METHYLSILOXANE)S CONTAINING 5-(S(-)-2-METHYL-1-BUTYL) 2-(4-(11-UNDECAN-1-YLOXY)PHENYL) 1,3,2-DIOXABORINANE AND 2-(4-(S(-) 2-METHYL-1-BUTOXY)PHENYL) 5-(11-UNDECAN-1-YL) 1,3,2-DIOXABORINANE CONSTITUTIONAL ISOMERIC SIDE GROUPS

Virgil Percec and C. S. Wang 10 Apr. 1991 12 p

(Contract N00014-90-J-1828)

(AD-A235787; TR-45) Avail: NTIS HC/MF A03 CSCL 07/3

Previous lab publications reported the results of investigations on the molecular engineering of phase transitions of side chain liquid crystalline polymers by using constitutional isomers of rigid rod-like mesogenic groups. Homopolymers based on constitutional isomeric rigid rod-like mesogens exhibit almost identical phase behavior. However, since their structural units are isomorphic within their mesophase and nonisomorphic within their crystalline phase, copolymers based on constitutional isomeric mesogens exhibit an isotropization temperature which is about the weight averaged value of their homopolymers and a highly depressed melting transition temperature. Consequently, copolymerization of these constitutional isomeric mesogens can be used to transform virtual or monotropic mesophases into enantiotropic mesophases. In a previous publication it was reported that isotropization temperatures of homopolymers containing constitutional isomeric mesogens based on a combination of rigid rod-like and flexible moieties are highly different. GRA

N91-27986# Case Western Reserve Univ., Cleveland, OH. Dept. of Macromolecular Science.

SYNTHESIS AND CHARACTERIZATION OF POLYMETHACRYLATES, POLYACRYLATES, AND POLY(METHYLSILOXANE)S CONTAINING 4-(S(-)-2-METHYL-1-BUTOXY) 4'-(OMEGA-ALKAN-1-YLOXY)-ALPHA-METHYLSTILBENE SIDE GROUPS

Virgil Percec and C. S. Wang 10 Apr. 1991 40 p

(Contract N00014-90-J-1828)

(AD-A235788; TR-45) Avail: NTIS HC/MF A03 CSCL 07/6

Side chain liquid crystalline polymers exhibiting chiral smectic C mesophases are of interest for both theoretical and technological reasons which were reviewed recently. So far there are only few examples of side chain liquid crystalline polymers exhibiting mesophases. Previous lab experiments on the synthesis and characterization of side chain liquid crystalline polymers containing chiral centers in the mesogenic groups 13 to 14 led to polymers exhibiting SA mesophases. GRA

N91-27987# Case Western Reserve Univ., Cleveland, OH. Dept. of Macromolecular Science.

MOLECULAR ENGINEERING OF LIQUID CRYSTAL POLYMERS BY LIVING POLYMERIZATION. PART 15: MOLECULAR DESIGN OF REENTRANT NEMATIC MESOPHASES IN BINARY COPOLYMERS OF OMEGA-(4-CYANO-4'-BIPHENYL)OXY)ALKYL VINYL ETHERS

Virgil Percec and M. Lee 10 Apr. 1991 36 p
(Contract N00014-90-J-1828)
(AD-A235789; TR-43-Pt-15) Avail: NTIS HC/MF A03 CSCL 07/6

The reentrant nematic (n sub re) phase was discovered in 1975 in low molar mass liquid crystals. Since then it received substantial theoretical and experimental interest. The first side chain liquid crystalline polymer exhibiting a n sub re phase was reported in 1986. This polymer was based on a polyacrylate backbone, six methylenic units in the flexible spacer, and 4-cyano-4'-oxybiphenyl side groups. In the mean time, several other polyacrylates containing mesogenic units with cyano groups and spacer lengths with five or six atoms were reported to exhibit the unusual i-n-SAd-n sub re sequence. So far, there are two copolymerization experiments with a monomer whose polymer exhibits a n sub re phase and a monomer whose polymer exhibits a n or SA mesophase. GRA

N91-27988# Case Western Reserve Univ., Cleveland, OH. Dept. of Macromolecular Science.
ENGINEERING OF LIQUID CRYSTALLINE POLYMERS BY LIVING POLYMERIZATION. PART 12: SYNTHESIS AND LIVING CATIONIC POLYMERIZATION OF 4-(S(-)-2-METHYL-1-BUTOXY) 4'-(OMEGA-OXYALKYL-1-VINYL ETHER)-ALPHA-METHYLSTILBENE WITH OCTYL AND HEXYL ALKYL GROUPS
Virgil Percec, C. S. Wang, and M. Lee 10 Apr. 1991 11 p
(Contract N00014-90-J-1828)
(AD-A235790; TR-47-Pt-12) Avail: NTIS HC/MF A03 CSCL 07/6

The synthesis and living cationic polymerization of 4-S(-)-2-methyl-butoxy-4'-(8-oxyoctyl-1-vinyl ether)-a-methylstilbene and 4-S(-)-2-methyl-1-butoxy-4'-(6-oxyhexyl-1-vinyl ether)-a-methylstilbene with the initiating system CF3SO3H/(CH3)2S in methylene chloride at 0 C are described. Both poly and poly exhibit an enantiotropic mesophase which is characterized by a focal conic texture with equidistant lines (most) probable at sc* phase). GRA

N91-27989# Case Western Reserve Univ., Cleveland, OH. Dept. of Macromolecular Science.
MOLECULAR ENGINEERING OF LIQUID CRYSTAL POLYMERS BY LIVING POLYMERIZATION. PART 13: SYNTHESIS AND LIVING CATIONIC POLYMERIZATION OF 4-((S(-)-2-METHYL-1-BUTYL)OXYCARBONYL) 4'-(OMEGA-OXYALKYL-1-VINYL ETHER)BIPHENYL WITH UNDECANYL AND HEXYL ALKYL GROUPS
Virgil Percec, Q. Zheng, and M. Lee 10 Apr. 1991 33 p
(Contract N00014-90-J-1828)
(AD-A235791; TR-48-Pt-13) Avail: NTIS HC/MF A03 CSCL 07/6

The synthesis and living cationic polymerization of 4 S(-) 2-methyl-1 butyloxycarbonyl-4' (11 oxyundecanyl-1 vinyl ether) biphenyl (12-11) and 4 S(-) 2-methyl-1 butyloxcarbonyl-4' -(6 oxyhexyl-1 vinyl ether biphenyl (12-11) and 1-vinyl ether biphenyl (12-6) are described. Polymers with degrees of polymerization from four to twenty six and polydispersities equal and lower than 1,10 were synthesized and characterized by differential scanning calorimetry (DSC) and thermal optical polarized microscopy. When determined from first heating and cooling DSC scans, poly exhibit monotropic SA, SC* and SX (unidentified) mesophases over the entire range of molecular weights. When determined from second and subsequent heating and first and subsequent cooling scans, poly with degrees of polymerization equal to ten and lower than ten exhibit enantiotropic SA, SC* and SX mesophases, and crystallization on the heating scan, while those with higher degrees of polymerization exhibit enantiotropic SA, SC* and SX mesophases only. GRA

N91-27990# Lowell Univ., MA. Dept. of Chemistry.
STEADY STATE AND TRANSIENT PHOTOCONDUCTIVITY OF THIN FILM POLYDIACETYLENE SINGLE CRYSTALS Technical Report No. 15, 1 Jun. 1990 - 31 May 1991
Y. Yang, J. Y. Lee, P. Miller, L. Li, and J. Kumar 3 May 1991 8 p
(Contract N00014-90-J-1148)
(AD-A235854; Rept-1148-15) Avail: NTIS HC/MF A02 CSCL 20/2

Charge carrier generation and transport mechanisms in polydiacetylene thin film single crystals, poly-PTS (2,4-hexadiyne 1,6-diol bis-(p-toluene sulfonate)) and poly-BTFP (bis-(4-n-butyl 2,3,5,6-tetra fluorophenyl) butadiyne), are studied by using steady state and transient photoconductivity techniques. The electric field dependence of the steady state photocurrent is superlinear for both samples. Dependence of photocurrent on incident light polarization has been investigated. The polarization dependence of photocurrent has completely different behavior for the polydiacetylene PTS and BTFP. Single-gap transmission line experiment has been designed to directly measure the drift velocity of PTS single crystals. A drift velocity of the order of 10(exp 6) cm/s was measured. GRA

N91-27991# Lowell Univ., MA. Dept. of Chemistry.
PHOTO-INDUCED CHARGE CARRIER GENERATION IN THIN FILM POLYDIACETYLENE SINGLE CRYSTALS Technical Report No. 19, 1 Jun. 1990 - 31 May 1991
Y. Yang and J. Y. Less 3 May 1991 13 p
(Contract N00014-90-J-1148)
(AD-A235860; Rept-1148-19) Avail: NTIS HC/MF A03 CSCL 20/12

Investigation of the angular dependence of incident light polarization on the photocurrent in thin film polydiacetylene single crystals with different side groups is reported. These experiments, show for the first time that charge carrier generation in these quasi-one-dimensional semiconductors is very sensitive to the nature and organization of the side groups. Models explaining photocarrier generation in such materials need to be reevaluated in light of these experimental results. GRA

N91-27992# Case Western Reserve Univ., Cleveland, OH. Dept. of Macromolecular Science.
MOLECULAR ENGINEERING OF LIQUID CRYSTAL POLYMERS BY LIVING POLYMERIZATION. PART 14: SYNTHESIS AND CHARACTERIZATION OF BINARY COPOLYMERS OF OMEGA-4-CYANO-4'-BIPHENYL)OXYALKYL VINYL ETHERS CONTAINING UNDECANYL AND HEXYL, PENTYL, AND PROPYL, AND UNDECANYL AND PROPYL PAIRS OF ALKYL GROUPS
Virgil Percec and Myongsoo Lee 10 Apr. 1991 37 p
(Contract N00014-90-J-1828)
(AD-A235909; TR-49-Pt-14) Avail: NTIS HC/MF A03 CSCL 07/6

Copolymerization represents the simplest synthetic technique which can be used to tailor make phase transitions of both main chain and side chain liquid crystalline polymers. Indeed, copolymerization was frequently employed to manipulate the phase transitions of side chain liquid crystalline polymers. However, most of the results reported in the literature can be considered only in a qualitative way, since there are only very few cases in which information about both copolymer composition and molecular weight are available. A general classification of side chain liquid crystalline copolymers was recently discussed in a review article. There are two main classes of side chain liquid crystalline copolymers. The first one refers to copolymers containing pairs of structural units with and without mesogenic units. This class of copolymers was extensively investigated. The second class refers to copolymers based on pairs of structural units containing mesogenic units in each one. GRA

N91-27993# Wisconsin Univ., Madison. Dept. of Chemistry.
CHEMICAL SENSING APPLICATIONS OF SEMICONDUCTOR PHOTOLUMINESCENCE
Elizabeth R. Luebker, Larry K. Leung, Catherine J. Murphy, George C. Lisensky, and Arthur B. Ellis 20 May 1991 36 p
(Contract N00014-85-K-0631)

(AD-A235935; UWIS/DC/TR-91/2) Avail: NTIS HC/MF A03 CSCL 07/5

Semiconductor-derived interfaces have applications in chemical sensing because the bulk photoluminescence (PL) intensity of the semiconductor can be perturbed by chemical adsorption at the surface. Using changes in PL intensity, we have created semiconductor-based systems for non-destructive, in situ, on-line chemical sensing. This paper presents practical applications of PL-based chemical sensors. We have investigated the use of semiconductor PL in a headspace analysis, and in the detection of compounds dissolved in hydrocarbon solution and in aqueous solution. We have constructed two portable systems using semiconductor sensors, where the excitation source, semiconductor, and detection electronics can be transported and used as an on-line system at remote locations. These sensors can be used to detect various classes of compounds in both the liquid and gas phases. GRA

N91-27994# Indiana Univ., Bloomington. Dept. of Physics.
HREELS STUDIES OF Al ADSORPTION ON Si(111)
G. S. Glander, P. Akavoor, and L. L. Kesmodel 1 May 1991 16 p
(Contract N00014-89-J-1775)
(AD-A235960; TR-3) Avail: NTIS HC/MF A03 CSCL 09/1

The search for a better understanding of the metal-semiconductor interface is an on going theme in surface research. Many different techniques have been applied to study a variety of metal-semiconductor systems to further this understanding. It is significant when many techniques have been applied to the same interface, building up a complete picture of its physical properties, and providing a case study for theorists to test their models and calculation methods against. We report here the results of a high-resolution electron energy loss spectroscopy (HREELS) study at zero momentum transfer. This is the first part of a study that will map out the full phonon dispersion. GRA

N91-27995# Case Western Reserve Univ., Cleveland, OH. Dept. of Macromolecular Science.
MOLECULAR ENGINEERING OF LIQUID CRYSTAL POLYMERS BY LIVING POLYMERIZATION. PART 11: SYNTHESIS AND CHARACTERIZATION OF POLY(11-((4-CYANO 4'TRANS-A-CYANOSTILBENE)OXY)UNDECANYL VINYL ETHER)
Virgil Percec, A. S. Gomes, and M. Lee 10 Apr. 1991 23 p
(Contract N00014-89-J-1828)
(AD-A235963; TR-42-Pt-11) Avail: NTIS HC/MF A03 CSCL 07/6

A convenient method for the synthesis of 11 (4-cyano-4' trans-alpha cyanostibene) oxyundecanyl vinyl ether (6) which is the first member of a new class of mesogenic monomers is described. The polymerization of 6 initiated with CF3SO3H/S(CH3)2 in methylene chloride proceeds through a living cationic mechanism leading to polymers with controllable molecular weights and polydispersities narrower than 1.10. The mesomorphic behavior of both 6 and poly(6)s with various molecular weights was determined by using a combination of thermal optical polarized microscopy and differential scanning calorimetry. Six is only crystalline. Poly(6)s with degrees of polymerization from 4 to 30 exhibit an enantiotropic smectic A mesophase and side chain crystallization. GRA

N91-27996# Wisconsin Univ., Madison. Dept. of Chemistry.
PHOTOLUMINESCENCE STUDIES OF SILVER-EXCHANGED CADMIUM SELENIDE CRYSTALS. MODIFICATION OF A CHEMICAL SENSOR FOR ANILINE DERIVATIVES BY HETEROJUNCTION FORMATION
Larry K. Leung, Norma J. Komplin, Arthur B. Ellis, and Ned Tabatabaie 20 May 1991 47 p
(Contract N00014-85-K-0631)
(AD-A236000; UWIS/DC/TR-91/4) Avail: NTIS HC/MF A03 CSCL 20/2

Single-crystal n-CdSe surfaces have been modified by an exchange reaction with aqueous Ag(+) that converts part of the surface to Ag2Se and releases Cd2(+) to solution. Formation of Ag2Se is established by x ray powder diffraction. The ESCA and Auger spectroscopy are consistent with the formation of Ag2Se islands having thicknesses of 0 to 500 A, depending on reaction conditions. Steady-state photoluminescence (PL) experiments show that Ag(+)-exchanged CdSe (CdSe/Ag(+)) can be superior to CdSe as an aniline sensor: ring-substituted aniline derivatives in toluene solution cause enhancements of the CdSe band edge PL in CdSe/Ag(+) samples relative to a toluene ambient, with the effect about twice as large as for unexchanged CdSe. The variations in PL intensity of CdSe/Ag(+) are well fit by a dead-layer model, allowing estimation of the adduct-induced change in depletion width. GRA

N91-27997# Army Research Office, Research Triangle Park, NC.
RESEARCH AND TECHNOLOGY TRANSFER ION IMPLANTATION TECHNOLOGY FOR SPECIALTY MATERIALS: PROCEEDINGS OF A JOINT WORKSHOP
Robert R. Reeber Feb. 1991 50 p Workshop held in Knoxville, TN, 26-27 Oct. 1989
(AD-A236060; ARO-WRKSP-R91-01) Avail: NTIS HC/MF A03 CSCL 20/5

The ion implantation research and technology transfer workshop brought together a diverse group of academic, industrial, and government participants. Several key issues highlighted were: (1) a need exists for new technology transfer infrastructures between universities, research labs and industry; (2) ion implantation technology has promise for several Army and industry applications because of environmental concerns and technological benefits; (3) the U.S. ion implantation industry is primarily service oriented; and (4) the cost of ion implantation technology could be significantly reduced if larger scale production equipment was available for on-line processing. A need exists in the U.S. for mechanisms and funds to develop such equipment. GRA

N91-27998# California Univ., San Diego, La Jolla. Dept. of Electrical and Computer Engineering.
COMPENSATING-STRESS InAs QUANTUM WELLS FOR HIGH-PERFORMANCE ELECTRONIC DEVICES Final Report, Sep. 1988 - Sep. 1990
C. W. Tu 29 Nov. 1990 80 p
(Contract F33615-88-C-1861)
(AD-A236073; WRDC-TR-90-5032) Avail: NTIS HC/MF A05 CSCL 09/1

In this contract we have investigated various approaches the InAs molar fraction in an InGaAs-channel MODFET. Conventional solid-source MBE and hydride-source MBE were used. Key accomplishments included: Establishing a baseline AlGaAs/InGaAs pseudomorphic MODFET technology. Using an (InAs)2(GaAs)2 superlattice grown by migration-enhanced epitaxy at 400 C as better luminescence properties and device performance than MBE-grown random-alloy In(0.4)Ga(0.6)As as the channel layer. Setting up a gas-source MBE system with elemental group-III and doping sources and arsine and phosphine. Establishing precisely the V/III atomic ratio on the growing surface during gas-source MBE by using the RHEED oscillation technique in the group-V-limited growth mode. Obtaining some preliminary results on modulation-doped, pseudomorphic InGaP/InGaAs. GRA

N91-27999# State Univ. of New York, Binghamton. Center for Leadership Studies.
ACTIVATED-SURFACE CHEMICAL VAPOR DEPOSITION Final Report, 1 May 1989 - 31 Aug. 1990
Alan Gallagher 25 Feb. 1991 39 p
(Contract MIPR-FY1455-88-N051; AF Proj. 2301)
(AD-A236083; WRDC-TR-90-2118) Avail: NTIS HC/MF A03 CSCL 07/4

The purpose of this study has been to construct and to achieve operation of a high-resolution, ultra high vacuum scanning tunneling microscope (STM) and to use the instrument to reveal the chemistry and physics of surface modification, etching or deposition that can be induced by the STM current. Typical approaches to the

operational requirements of the STM are described: (1) The mechanical structure of the STM must allow a large range of 3-dimensional motion, yet be sufficiently rigid and isolated from external vibrations to provide less than 1 angstrom vibration of the tip-sample gap and lateral position. (2) Piezoelectrics used in STMs normally depolarize below 200 C, thus limiting vacuum bakeout temperatures to around 150 C. A turbomolecular pump combined with ion and titanium sublimation pumps is used to reach 10 to 10 torr (UHV). (3) Tungsten tips of a few hundred angstroms radius are produced by suspending a wire in an etching solution with the weight or size of the wire hanging below the neck minimized and the current rapidly terminated after the wire breaks. GRA

N91-28000# Utah Univ., Salt Lake City. Dept. of Chemistry.
QUANTITATIVE INVESTIGATION OF CHARGE-TRAPPING EFFECTS ON RAMAN SPECTRA ACQUIRED USING CHARGE-COUPLED DEVICE (CCD) DETECTORS Technical Report, Jun. 1990 - May 1991
W. B. Lacey, K. L. Rowlen, and J. M. Harris 22 May 1991 25 p
(Contract N00014-89-J-1412)
(AD-A236101) Avail: NTIS HC/MF A03 CSCL 20/5

Changes in spectral band parameters (width, center frequency, intensity) which arise from charge trapping artifacts in the Thomson TH 7882 charge coupled device (CCD) detector are reported. These parameters are measured for a Raman scattering band of carbon tetrachloride with respect to CCD geometry (parallel versus serial binning), in the presence and absence of preflash, versus changes in integration time (variation in detected light level). The dependence of the spectral parameters on detector temperature was also measured. The degree of charge trapping and the charge transfer efficiency were estimated from the change in peak width and intensity versus integration time, respectively, and were found to vary with detector temperature according to an Arrhenius relationship for the serial-binning geometry; from these results, the energy barriers to charge trapping and loss in the serial register were estimated. Practical guidelines for acquisition of binned spectra with this detector are suggested. GRA

N91-28001# University of South Florida, Tampa. Dept. of Electrical Engineering.
LASER INDUCED CHEMICAL VAPOR PHASE EPITAXIAL GROWTH OF III-V SEMICONDUCTOR FILMS
Shirley S. Chu and Ting L. Chu 14 May 1991 56 p
(Contracts SDIO84-89-C-0024; N00014-90-C-0032)
(AD-A236207) Avail: NTIS HC/MF A04 CSCL 20/12

The objective of this project is to investigate the homo- and hetero-epitaxial growth of device quality III-V semiconductor films by the free electron laser (FEL) induced growth at lower temperatures. An ArF excimer laser was used in this investigation. Metalorganic vapor phase epitaxy (MOVPE) is the commonly used technique in the growth of III-V compounds and alloys. The major concern to the use of MOVPE is the hazard involved in using highly toxic arsine and phosphine gases as the group V source materials. Efforts during this period have been focused to the homoepitaxial growth of GaAs and heteroepitaxial growth of InP on GaAs using alternate sources to eliminate the use of arsine and phosphine. Good quality epitaxial GaAs films have been prepared from elemental arsenic for the first time by either conventional substrate heating or laser enhanced processes. The epitaxial GaAs films grown from elemental arsenic are suitable for many GaAs based devices, particularly for large area devices such as solar cells. Significant cost reduction and less stringent safety requirements are major advantages. GRA

N91-28002# Arizona Univ., Tucson. Optical Sciences Center.
STUDY OF SEMICONDUCTOR CLUSTERS BY LOCAL INVERSE PHOTO EMISSION
Dror Sarid 1991 9 p
(Contract N00014-89-J-1645)
(AD-A236210) Avail: NTIS HC/MF A02 CSCL 20/7

The project of building the first system consisting of a scanning tunneling microscope operating in ultra-high vacuum is completed, and all the components are now operational. STM images of charge-density waves in UHV were successfully obtained. Two other systems were developed and operated that enable performance of the task delineated in the original ONR proposal. The second system is a computerized nanolithography station where computer generated patterns drive the STM tip, which deposits atoms at the pre-prescribed locations. The third system measures the photon emission from nanostructures using a cooled photomultiplier, a photon counter, and an image processor. Several papers are currently being written that describe the theory of photon emission from STM-deposited patterns and the various experiments performed with these three systems. Enclosed is a list of publications describing our STM work. Future plans call for the refinement of the experiments where clusters are written and their light emission recorded and analyzed topographically and spectroscopically. GRA

N91-28003# Strathclyde Univ., Glasgow (Scotland). Dept. of Physics.
LASER SPECTROSCOPY OF QUANTUM WELL AND SUPERLATTICE STRUCTURES Final Technical Report, 4 Jun. 1990 - 3 Feb. 1991
B. Henderson 4 Jun. 1990 34 p
(Contract DAJA45-88-C-0006)
(AD-A236232; R/D-5782-EE-01) Avail: NTIS HC/MF A03 CSCL 20/12

The potential for tailoring band structures of semiconductors with specific properties using molecular beam epitaxy (MBE) and metallorganic chemical vapor deposition (MOCVD) has considerable significance for future electronic and optoelectronic devices. These techniques permit the growth of structure with alternating layers of two semiconductors on top of each other which have band structures that alternate with characteristic peridocity giving a 1-D Kronig-Penney structure. Superlattices are grown with well widths ranging from 1 to 50 nm with rather thicker barriers. Electrons and holes are confined in the potential wells in the conduction and valence bands respectively. The transition rates of these excitonic luminescence processes should be given by the inverse of the radiative lifetime, tau sub R, leading to a homogeneous linewidth Delta omega = 1/tau sub R. At low temperature the exciton linewidth for a typical 5.0 nm well in GaAs is about 100 times larger than in bulk material, which is already inhomogeneously broadened by the effects of strain. Obviously the exciton luminescence line experiences an additional inhomogeneous broadening which dominates the experimental linewidth. GRA

N91-28004# Columbia Univ., New York, NY. Dept. of Electrical Engineering.
NARROW GAP SUPERLATTICES FOR INFRARED SENSOR APPLICATION Final Report, 9 May 1989 - 8 May 1990
Wen I. Wang 24 May 1991 6 p
(Contract N00014-89-K-2020)
(AD-A236355) Avail: NTIS HC/MF A02 CSCL 20/12

The emphasis of our research under this program is to obtain high quality narrow gap superlattices for infrared sensor applications. During this initial phase of research, all the fundamental work necessary for future achievement of high quality metastable materials has been completed. This work includes the growth of all the various buffer layer materials such as InAs, InSb, GaSb, and AlSb, the calibration of the Auger system for quick feedback of alloy composition, and the in-situ RHEED oscillation calibration of growth rate. GRA

N91-28005# Alabama Univ., Tuscaloosa. Dept. of Chemistry.
ULTRA THIN FILM CHARACTERIZATION OF THE ORGANIC RECTIFIER PROJECT Final Report, 1 Aug. 1986 - 31 Jul. 1988
Robert M. Metzger 5 May 1991 70 p
(Contract N00014-86-G-0215)
(AD-A236360) Avail: NTIS HC/MF A04 CSCL 09/1

The discovery of superconductivity at high temperatures has generated considerable effort toward understanding the physical properties of bismuth and copper oxides. It is important to recognize

that these oxides are members of the broad class of perovskite and simple transition metal oxides that usually do not exhibit metallic conductivity and even less often exhibit superconductivity. As part of an overall understanding of high temperature superconductivity, it is important to understand the fundamental electronic energies that determine why some oxides are metallic, whereas the majority have low conductivity. It is these fundamental energies for the undoped oxide systems that provide the basis for understanding the hole doped systems and lie behind the assumptions of the various theories for high-temperature superconductivity. GRA

N91-28006# Minnesota Univ., Minneapolis. Dept. of Chemistry.
MIXED VALENCE IN CONJUGATED ANION RADICALS. SOLUTION AND SOLID STATE STUDIES
Stanton F. Rak, Charles A. Liberko, and Larry L. Miller 24 May 1991 11 p
(Contract N00014-90-J-1569)
(AD-A236428; TR-10) Avail: NTIS HC/MF A03 CSCL 07/3

Electron localization in anion radicals of aromatic compounds built with two electrophores was studied using Vis, NIR, IR, and ESR spectroscopy and electrochemistry. N,N'-bis-(2,5-di-tert-butyl phenyl)-2,3,6,7,-antracene-dicarboximide anion radical has the odd electron mainly localized on the anthracene bridge. This contrasts with its diquinone analog, 1,4,8,11-pentacenetetrone, which has the odd electron localized on one quinone at a time. The anion radical of the tetrakis-(N-cyanoimine) derivative of 5,7,12,14-pentacenetetrone (3-) is delocalized. GRA

N91-28007# Harry Diamond Labs., Adelphi, MD.
POSSIBLE HOSTS FOR QUADRUPLY IONIZED 3d(SUP N) TRANSITION METAL IONS: Na2TiSiO5, Y2SiBe2O7, Bi4X3O12, AND Bi12XO20 (X = Si, Ge) Interim Report, 1 Jun. - 15 Aug. 1990
Clyde A. Morrison May 1991 55 p
(AD-A236543; HDL-TM-91-1) Avail: NTIS HC/MF A04 CSCL 20/5

This report provides the crystal-field splitting of Cr4(+) in the host materials Na2TiSiO5, Y2SiBe2O7, Bi4X3O12, and Bi12XO20. The strength of the crystal field is estimated by evaluating the coefficients of a multipole expansion of the crystal field for the Ti, Si, or Ge site and using empirical values of the radial integrals. With the exception of the Ti site in Na2TiSiO7, the Si or Ge sites are, to a certain degree, approximately tetrahedral. In the material Bi12XO20 the X site (Ge or Si) has the cubic symmetry T. Estimated values of the parameters for the quadruply ionized 3dn electronic configurations are given for X = Ge. The energy levels are calculated with and without the spin-orbit interaction. GRA

N91-28008# Advanced Technology Materials, Inc., Danbury, CT.
MOCVD OF TlBaCaCuO ON MgO USING FLUORINATED BETA-DIKETONATE SOURCE REAGENTS
Norihito Hamaguchi, Steven A. Jones, Robin A. Gardiner, and Peter S. Kirlin 31 May 1991 8 p
(Contract N00014-90-C-0201)
(AD-A236594) Avail: NTIS HC/MF A02 CSCL 20/12

Superconducting Tl2Ba2CaCu2O(x) films were fabricated using a three step process. In the first step, amorphous BaCaCuOF films were deposited on MgO(100) single crystal substrates by metalorganic chemical vapor deposition at 500 C using fluorinated beta-diketonate complexes of Ba, Ca, and Cu. The fluorine was stripped from the BaCaCuOf films in the second step by annealing in wet O2 at 785 C. The C-axis oriented Tl2Ba2CaCu2O(x) films were formed in the final step by annealing the BaCaCuO in dry O2 at temperatures between 850 and 900 C in the presence of Tl2O3Ba2Ca2Cu3O(x) pellets. The physical properties of the films were characterized by SEM, XRD, and RBS, and the electrical properties were evaluated with four point probe and microwave cavity measurements. Resistive transitions as high as 109 K have been obtained. The best films showed critical current density as high as 10,000 A/sq cm at 90 K and surface resistances 1/2 to 1/5 that of a gold standard at 17 GHz and 77 K. GRA

N91-28009# California Inst. of Tech., Pasadena. Dept. of Applied Physics.
PHYSICS AND CHEMISTRY OF SMALL SCALE STRUCTURES FOR MODERN DEVICES Final Report, 1 Aug. 1984 - 31 Mar. 1989
T. C. McGill 1 Jun. 1991 57 p
(Contract N00014-84-K-0501)
(AD-A236680) Avail: NTIS HC/MF A04 CSCL 20/5

Under the support of this contract a number of major contributions were made to the development of nanostructures for microelectronics. Fundamental studies of growth have led to a better understanding of the role of strain in epitaxial layers grown on semiconductor substrates. The possibilities for growing superconductors on semiconductors and vice-versa have taken a major step forward with the successful growth of vanadium III silicon on silicon. The basic theory of tunnel devices including the role of phonons and self-consistency have been explored. New device structures based on the combination of III-V and II-VI semiconductors have also been examined. GRA

N91-28010# Wisconsin Univ., Madison.
DIFFRACTION DETERMINATION OF THE STRUCTURE OF METASTABLE THREE-DIMENSIONAL CRYSTALS OF Ge GROWN ON Si(001)
C. E. Aumann, Y. W. Mo, and M. G. Lagally 25 May 1991 14 p
(Contract N00014-90-J-1119)
(AD-A236871) Avail: NTIS HC/MF A03 CSCL 20/5

A straightforward kinematic analysis of diffraction from metastable three-dimensional crystallites of Ge grown on Si(001) is presented. Low-energy electron diffraction data from these crystallites are shown to agree with diffraction images calculated for a structure determined from scanning-tunneling microscopy data. Additionally, reflection high-energy electron diffraction images predicted for these crystals agree with existing data. GRA

N91-28011# Advanced Technology Materials, Inc., Danbury, CT.
MOCVD OF TlBaCaCuO SUPERCONDUCTING THIN FILMS: STRUCTURE, PROPERTY, PROCESSING RELATIONSHIPS
Norihito Hamaguchi, Robin A. Gardiner, and Peter S. Kirlin 31 May 1991 19 p
(Contract N00014-90-C-0201)
(AD-A236881; TR-3) Avail: NTIS HC/MF A03 CSCL 20/3

Superconducting TlBaCaCuO films were fabricated using a three step process. Amorphous BaCaCuOF films were grown on MgO(100) single crystal substrates by metalorganic chemical vapor deposition at 500 C and 4 torr using fluorinated BETA-diketonate complexes of Ba, Ca, and Cu. The fluorine was stripped in wet O2 at 785 C and c-axis oriented Tl2Ba2CaCu2O(x) films were formed by annealing in dry O2 between 850 and 900 C in the presence of Tl(x)O(y) vapor. The best films showed onsets of superconductivity at 125 K and zero resistivity was achieved by 109 K. Surface resistivities an order of magnitude lower than gold at 17 GHz (77 K) and J(sub c)s as high as 1000 A/cm sq (90 K) were obtained with unpatterned films. GRA

N91-28012# Texas Instruments, Inc., Dallas.
FEW-ELECTRON LATERAL RESONANT TUNNELING SEMICONDUCTOR DEVICES Final Technical Report, Jun. 1989 - Feb. 1991
R. T. Bate, J. Luscombe, W. R. Frensley, J. N. Randall, and M. A. Reed Apr. 1991 90 p
(Contract N00014-89-C-0091)
(AD-A236901; TI-08-91-09) Avail: NTIS HC/MF A05 CSCL 20/3

The effort here included design, modeling, fabrication, and characterization of lateral resonant tunneling and quantum point contact structures. Also included was a theoretical investigation of open quantum systems driven far from equilibrium, with emphasis on appropriate boundary conditions for solution of such systems. Accomplishments under this contract include the publication in Reviews of Modern Physics of the results of this foundational

study, as well as the development of a graphics-oriented program for the computation and display of two-dimensional self-consistent energy band diagrams. The first lateral resonant tunneling transistors to exhibit both negative differential conductance and negative transconductance were demonstrated. The eigenstates of finite superlattices driven below the Stark localization threshold were also observed. GRA

N91-28013# Brown Univ., Providence, RI. Div. of Engineering.
OPTICAL AND MAGNETIC SPECTROSCOPY AT INTERFACES OF STRAINED SEMICONDUCTOR SUPERLATTICES Final Report, Aug. 1985 - 30 Sep. 1989
Arto V. Nurmikko May 1991 24 p
(Contract N00014-83-K-0638)
(AD-A236978) Avail: NTIS HC/MF A03 CSCL 20/12

This document summarizes research activities in a rapidly developing area of compound semiconductor superlattices. The area concerns materials based on the II-VI and, to a lesser extent, on the IV-VI compound semiconductors. Advances in modern epitaxy have made it possible to generate versatile layered structures. The emphasis in the work described below was especially on ultrathin layer structures where individual constituent layers approach atomic dimensions (monolayer limit). The description below provides a summary of recent accomplishments under ongoing ONR support. The new opportunities which exist for the proposed research are very much based on the physical understanding in terms cf specific microscopic phenomena which has been accumulated in the principal investigators laboratory in the past two years, in concert with collaborators elsewhere. Of general physical interest were electronic, magnetic, and vibrational excitations near the 2D limit, especially in circumstances where coupling of such elementary excitations was a factor. The research also has a applied connection to optical and magneto-optical devices such as modulators and magneto-optical switches and storage elements. GRA

N91-28014* National Aeronautics and Space Administration. Pasadena Office, CA.
THERMAL TREATMENT OF SILICON INTEGRATED CIRCUIT CHIPS TO PREVENT AND HEAL VOIDS IN ALUMINUM METALLIZATION Patent
Edward F. Cuddihy, inventor (to NASA), Russell A. Lawton, inventor (to NASA), and Thomas R. Gavin, inventor (to NASA) (Jet Propulsion Lab., California Inst. of Tech., Pasadena.) 28 May 1991 8 p Filed 26 May 1989 Sponsored by NASA
(NASA-Case-NPO-17678-1-CU; US-Patent-5,019,533; US-Patent-Appl-SN-357758; US-Patent-Class-437-199; US-Patent-Class-437-187; US-Patent-Class-437-197; US-Patent-Class-437-247; US-Patent-Class-437-248; US-Patent-Class-357-82; Int-Patent-Class-H01L-21/324) Avail: US Patent and Trademark Office CSCL 20L

Voids in aluminum metallization conductors on a chip are avoided or healed after the chip is subjected to thermal treatment at a high temperature sufficient to allow diffusion of silicon by rapidly cooling the chip, preferably by immersion of the chip in liquid nitrogen.

Official Gazette of the U.S. Patent and Trademark Office

N91-28078*# Alabama A & M Univ., Huntsville. Dept. of Physics.
GROWTH AND CHARACTERIZATION OF CRYSTALS FOR IR DETECTORS AND SECOND HARMONIC GERERATION DEVICES
Ravi B. Lal, Ashok K. Batra, Sistla M. Rao, S. S. Bhatia, Kunar P. Chunduru, Ron Paulson, and Tripty K. Moorkherji (Teledyne Brown Engineering, Huntsville, AL.) *In its* NASA-HBCU Space Science and Engineering Research Forum Proceedings 1989 p 84-89 Sponsored in part by Clarkson Univ. (For primary document see N91-28063 19-99)
Avail: NTIS HC/MF A23 CSCL 20L

N91-28080*# Alabama A & M Univ., Huntsville. Dept. of Physics.
SOLUTION GROWTH OF TRIGLYCINE SULFATE (TGS) CRYSTALS ON THE INTERNATIONAL MICROGRAVITY LABORATORY (IML-1)
Ravi B. Lal, Ashok K. Batra, Li Yang, W. R. Wilcox, and J. D. Trolinger (MetroLaser, Irvine, CA.) *In its* NASA-HBCU Space Science and Engineering Research Forum Proceedings 1989 p 96-100 (For primary document see N91-28063 19-99)
(Contract NAS8-36634)
Avail: NTIS HC/MF A23 CSCL 20L

N91-28089*# Fisk Univ., Nashville, TN. Dept. of Physics.
PURIFICATION, GROWTH, AND CHARACTERIZATION OF Zn(x)Cd(1-x)Se CRYSTALS
E. Silberman, A. Burger, W. Chen, D. O. Henderson, S. H. Morgan, John M. Springer, and Y. Yao *In* Alabama A & M Univ., NASA-HBCU Space Science and Engineering Research Forum Proceedings 1989 p 188-19 (For primary document see N91-28063 19-99)
(Grant NAG8-113)
Avail: NTIS HC/MF A23 CSCL 20L

N91-28090*# Morgan State Univ., Baltimore, MD. Dept. of Physics.
A SCANNING ELECTRON MICROSCOPY STUDY OF THE MACRO-CRYSTALLINE STRUCTURE OF 2-(2,4-DINITROBENZYL) PYRIDINE
Jacqueline Ware and Ernest C. Hammond, Jr. *In* Alabama A & M Univ., NASA-HBCU Space Science and Engineering Research Forum Proceedings 1989 p 195-20 (For primary document see N91-28063 19-99)
Avail: NTIS HC/MF A23 CSCL 20L

N91-28091*# Howard Univ., Washington, DC. Dept. of Physics and Astronomy.
STRUCTURES OF CYANO-BIPHENYL LIQUID CRYSTALS
Yuan-Chao Chu, Tung Tsang, E. Rahimzadeh, and L. Yin *In* Alabama A & M Univ., NASA-HBCU Space Science and Engineering Research Forum Proceedings 1989 p 205-21 (For primary document see N91-28063 19-99)
(Grant NAG5-156)
Avail: NTIS HC/MF A23 CSCL 20L

N91-28092*# Virginia State Univ., Petersburg. Dept. of Physics.
STUDIES OF SUPERCONDUCTING MATERIALS WITH MUON SPIN ROTATION
Michael R. Davis, Carey E. Stronach, W. J. Kossler, H. E. Schone, X. H. Yu, Y. J. Uemura, B. J. Sternlieb, J. R. Kempton, J. Oostens, and W. F. Lankford (George Mason Univ., Fairfax, VA.) *In* Alabama A & M Univ., NASA-HBCU Space Science and Engineering Research Forum Proceedings 1989 p 211-21 Sponsored in part by DOE and Natural Sciences and Engineering Research Council (For primary document see N91-28063 19-99)
(Grants NAG1-416; NSF DMR-85-03223)
Avail: NTIS HC/MF A23 CSCL 20L

N91-28112*# Virginia State Univ., Petersburg. Dept. of Physics.
COMPUTER SIMULATION OF RADIATION DAMAGE IN GALLIUM ARSENIDE
John J. Stith, James C. Davenport, and Randolph L. Copeland *In* Alabama A & M Univ., NASA-HBCU Space Science and Engineering Research Forum Proceedings 1989 p 356-36 (For primary document see N91-28063 19-99)
Avail: NTIS HC/MF A23 CSCL 20L

N91-28118*# Howard Univ., Washington, DC. Dept. of Electrical Engineering.
CHARACTERIZATION OF QUANTUM WELL STRUCTURES USING A PHOTOCATHODE ELECTRON MICROSCOPE
Michael G. Spencer and Craig J. Scott (Naval Research Lab., Washington, DC.) *In* Alabama A & M Univ., NASA-HBCU Space

Science and Engineering Research Forum Proceedings 1989 p 405-40 (For primary document see N91-28063 19-99)
Avail: NTIS HC/MF A23 CSCL 20L

77 THERMODYNAMICS AND STATISTICAL PHYSICS

Includes quantum mechanics; theoretical physics; and Bose and Fermi statistics.

For related information see also *25 Inorganic and Physical Chemistry* and *34 Fluid Mechanics and Heat Transfer.*

N91-28015# Los Alamos National Lab., NM.
UNIFYING THE CONTROLLING MECHANISMS FOR THE CRITICAL HEAT FLUX AND QUENCHING: THE ABILITY OF LIQUID TO CONTACT THE HOT SURFACE
C. Unal, V. Daw, and R. A. Nelson 1990 44 p Presented at the ASME/AIChE/ANS National Heat Transfer Conference, Minneapolis, 26-31 Jul. 1991
(Contract W-7405-eng-36)
(DE91-005946; LA-UR-90-4370; CONF-910739-3) Avail: NTIS HC/MF A03

The hypothesis that the critical heat flux (CHF) occurs when some point on a heated surface reaches a temperature high enough so that liquid can no longer maintain contact at that point, resulting in a gradual but continuous increase in the overall surface temperature, was investigated. This hypothesis unifies the occurrence of the CHF with the quenching of hot surfaces by relating them to the same concept: the ability of a liquid to contact a hot surface, generally defined as some fraction of liquid's homogeneous nucleation temperature, depending upon the contact angle. The proposed hypothesis about the occurrence of the CHF is investigated through study of the boiling mechanism of the second transition region of nucleate pool boiling. A two-dimensional transient conduction heat-transfer model was developed to investigate the heat-transfer mechanism. The initial macrolayer thickness on the dry portion of the heater, in the second transition region, was found to be bounded between 0 and 11 microns for a copper heater. The results indicated that the critical liquid-solid contact temperature at the onset of CHF must be lower than the homogeneous nucleation temperature of the liquid for the pool boiling of water on a clean horizontal surface. The liquid-solid contact temperature was dependent upon the initial liquid macrolayer thickness, varying from 180 to 157 C for initial macrolayer thicknesses of 0 and 11 microns, respectively. These values are in good agreement with extrapolated contact temperature data at the onset of film boiling. This indicates that the mechanism for the occurrence of the CHF could be similar to the mechanism generally accepted for the quenching of the hot surfaces. DOE

N91-28016# Los Alamos National Lab., NM.
USING CNLS-NET (CONNECTIONIST NORMALIZED LOCAL SPLINE-NETWORK) TO PREDICT THE MACKEY-GLASS CHAOTIC TIME SERIES
W. C. Mead, R. D. Jones, C. W. Barnes, L. A. Lee, M. K. ORourke, Y. C. Lee, and G. W. Flake (Maryland Univ., College Park.) 1991 7 p Presented at the 1991 International Joint Conference on Neural Networks (IJCNN), Seattle, 8-12 Jul. 1991
(Contract W-7405-eng-36)
(DE91-007478; LA-UR-91-324; CONF-910779-2) Avail: NTIS HC/MF A02

The Connectionist Normalized Local Spline (CNLS) network was used to learn the dynamics of the Mackey-Glass time-delay differential equation, for the case (tau) = 30. The optimum network operating mode was shown and the accuracy and robustness of predictions determined. Predictions were obtained for varying accuracy using some 2 to 120 minutes of execution time on a Sun SPARC-1 workstation. CNLS-net is capable of very good performance in predicting the Mackey-Glass time series. DOE

N91-28017# Naval Postgraduate School, Monterey, CA.
A COMPUTATIONAL AND EXPERIMENTAL STUDY OF FLUSH HEAT SOURCES IN LIQUIDS M.S. Thesis
Larry O. Haukenes Jun. 1990 145 p
(AD-A236836) Avail: NTIS HC/MF A07 CSCL 20/13

A numerical investigation of two-dimensional natural convection flow and heat transfer from a substrate-mounted flush heat source immersed in a liquid-filled square enclosure was conducted. The study is relevant to direct liquid-immersion cooling of electronic components. A control volume based finite difference model that accounts for conduction heat transfer within the substrate and heat source and the coupled natural convection in the fluid was utilized. Numerical predictions were obtained for a wide range of Rayleigh and Prandtl numbers, substrate to fluid and heat source to fluid thermal conductivity ratios, and other geometrical parameters that may be encountered in practice. An increase in Rayleigh number led to more vigorous flow and promoted cooling. No noticeable effect on the nondimensional temperature was observed when changing the Prandt number from 7 to 100. Little reduction in maximum temperatures was observed when substrate and component to fluid thermal conductivity ratios were increased beyond 10 and 25, respectively. The component to substrate width ratio change from .25 to .999 resulted in an approximately linear decrease in the maximum temperature. A companion experimental study of three dimensional natural convection transport from a flush mounted array of heat sources in water was also conducted. Computer temperatures compared favorably to appropriate experimental data. GRA

N91-28018# Utah State Univ., Logan. Dept. of Chemistry and Biochemistry.
TEMPERATURE-JUMP RELAXATION KINETICS AT LIQUID/SOLID INTERFACES: FLUORESCENCE THERMOMETRY OF POROUS SILICA HEATED BY A JOULE DISCHARGE Technical Report No. 28, Jun. 1990 - May 1991
S. W. Waite, E. H. Ellison, D. B. Marshall, and J. M. Harris 22 May 1991 33 p
(Contract N00014-89-J-1412)
(AD-A236850) Avail: NTIS HC/MF A03 CSCL 20/13

Temperature-jump relaxation techniques are adapted to measuring the kinetics of reversible reactions at interfaces of liquid phases/solid phases. In the present work, we determine whether fast temperature changes can be created within a packed bed of silica gel using Joule discharge heating. Fast heating of the surface of porous silica depends on the solution within the pores carrying current through the particle, since heat flow from the surrounding solution into the interior of the silica particle would generally be slow. To characterize the rate of heating of the silica surface, fluorescence thermometry was employed to measure the temperature rise at a liquid/solid interface on a microsecond time-scale. The 9,10 dichloroanthracene (9,10 DCA) was found to be a suitable probe molecule for fast fluorescence measurement of temperature changes at alkylated silica surfaces. For 10 micrometers silica particles, we observe an exponential relaxation of the temperature-dependent fluorescence intensity with a decay time that corresponds to the rate of energy deposition in the sample. These results indicate that ionic current flows through the silica, uniformly heating the surface area of smaller particle-size silica, uniformly heating the surface area of smaller particle-size silica. Larger particle silica shows a slower thermal relaxation indicating non-conductive domains which are heated on a slower time-scale by thermal conduction. GRA

N91-28019# Naval Postgraduate School, Monterey, CA.
ANALYSIS AND SYNTHESIS OF RADIATIVE HEAT TRANSFER IN LONGITUDINAL FINS IN FREE SPACE AND NON-FREE SPACE M.S. Thesis
Dennis R. Johnson Jun. 1990 158 p
(AD-A236942) Avail: NTIS HC/MF A08 CSCL 20/13

The objective of this thesis is to develop an interactive computer program that will analyze and synthesize radiative heat transfer in longitudinal fins. The analysis procedure determines the amount of heat transferred from the fin given the fin base temperature,

fin dimensions and thermal properties. The synthesis procedure is the converse problems: it determines the size of the fin required to dissipate a specified amount of heat given the thermal characteristics of the fin. In addition, the program is capable of performing the analysis/synthesis of three fin profiles (rectangular, trapezoidal and triangular) in two environments (free space and non-free space). Free space is considered as the absence of external heat sources or interception of the heat dissipated by the fin whereas non-free space includes the effect of external heat sources and neighboring structures. A theoretical analysis of heat transfer from radiating longitudinal fins will be presented along with a user oriented computer program. Finally, detailed examples will be provided to illustrate the different types of problems, profiles and environments. GRA

80 SOCIAL SCIENCES (GENERAL)

Includes educational matters.

N91-28020# Northwest Regional Educational Lab., Portland, OR.
THE TEMPORAL STRUCTURE OF COOPERATIVE ACTIVITY
Stephen Reder and Robert G. Schwab Oct. 1990 14 p Presented at the CSCW Proceedings, 1990
Avail: NTIS HC/MF A03

Developers of group-support technology often base their design on tacit assumptions about the nature of group work. At the same time, social scientists proclaim that cooperative work involves complex social and linguistic interactions among team members. One important facet of these interactions is considered: the nature of the relationship between individual work and group work activity. In particular, the relationship between the characteristic temporal and spatial patterning of behavior in the work environment and the modes of cooperative behavior. An attempt is made to develop a theoretical framework which addresses such questions in an empirically verifiable way. The framework begins with the observation that individuals in office settings must routinely resolve conflicts between: (1) having uninterrupted periods of time in which to get their own work done; and (2) being accessible for communication with others with whom they work. A study that was conducted among workers in a division of a Fortune 500 corporation is described. Author

N91-28021 Northwest Regional Educational Lab., Portland, OR.
THE COMMUNICATIVE ECONOMY OF THE WORKGROUP: MULTI-CHANNEL GENRES OF COMMUNICATION
Stephen Reder and Robert G. Schwab England Elsevier Science Publishers Ltd. 1991 19 p Reprint from Proceedings of the Conference on Computer-Supported Cooperative Work, Portland, 26-28 Sep. 1988
Copyright Avail: Issuing Activity

Drawing upon the classic methods of the ethnography of communication, some initial findings from a detailed study of communication among members of two workgroups (i.e., task-centered groups which may coincide with or may cut across standing organizational units) within a larger private sector organization are presented. Though part of an ongoing 3 year study of both communication and decision making processes in the workplace, particular aspects of observed communication activities are stressed. Three facets of group behavior systematically examined in this research are: (1) channel selection: which variables (e.g., characteristics of the group and its collaborative task) influence the group's selection of particular channels for communication (e.g., face-to-face conversation, telephone, computer-mediated communication such as electron mail), at specified points of the task; (2) channel effects: how the particular channel selected affects the group's communication (i.e., the content and structure of the messages); and (3) task outcomes: how the foregoing variables affect the explicit work of the group. Author

N91-28095*# Brandeis Univ., Waltham, MA. Dept. of Computer Science.
ENCOURAGING THE PURSUIT OF ADVANCED DEGREES IN SCIENCE AND ENGINEERING: TOP-DOWN AND BOTTOM-UP METHODOLOGIES
Anthony B. Maddox, Renee P. Smith-Maddox, and Benson E. Penick (Penick, Benson and Associates, Washington, DC) *In* Alabama A & M Univ., NASA-HBCU Space Science and Engineering Research Forum Proceedings 1989 p 240-24 (For primary document see N91-28063 19-99)
(Grant NGT-22-005-900)
Avail: NTIS HC/MF A23 CSCL 05I

N91-28096*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
JPL INITIATIVE ON HISTORICALLY BLACK COLLEGES AND UNIVERSITIES
Lew Allen, Paul Forte, Jr., and Martin H. Leipold *In* Alabama A & M Univ., NASA-HBCU Space Science and Engineering Research Forum Proceedings 1989 p 247-25 (For primary document see N91-28063 19-99)
Avail: NTIS HC/MF A23 CSCL 05I

N91-28098*# Gallaudet Coll., Washington, DC.
A MODEL SUMMER PROGRAM FOR HANDICAPPED COLLEGE STUDENTS
Anne B. Nissen *In* Alabama A & M Univ., NASA-HBCU Space Science and Engineering Research Forum Proceedings 1989 p 262-26 (For primary document see N91-28063 19-99)
Avail: NTIS HC/MF A23 CSCL 05I

N91-28099*# District of Columbia Univ., Washington, DC. Science and Engineering Center.
A SUCCESSFUL INTERVENTION PROGRAM FOR HIGH ABILITY MINORITY STUDENTS
Winson R. Coleman *In* Alabama A & M Univ., NASA-HBCU Space Science and Engineering Research Forum Proceedings 1989 p 266-26 (For primary document see N91-28063 19-99)
Avail: NTIS HC/MF A23 CSCL 05I

N91-28100*# Spelman Coll., Atlanta, GA.
THE WOMEN IN SCIENCE AND ENGINEERING SCHOLARS PROGRAM
Etta Z. Falconer and Lori Ann Guy *In* Alabama A & M Univ., NASA-HBCU Space Science and Engineering Research Forum Proceedings 1989 p 270-27 (For primary document see N91-28063 19-99)
Avail: NTIS HC/MF A23 CSCL 05I

81 ADMINISTRATION AND MANAGEMENT

Includes management planning and research.

N91-28022# Allen Corp. of America, Alexandria, VA.
HANDBOOK FOR CONDUCTING ANALYSIS OF THE MANPOWER, PERSONNEL, AND TRAINING ELEMENTS FOR A MANPRINT ASSESSMENT Final Report, Sep. 1985 - Oct. 1987
Jose H. Guerrier, John C. Lowry, Robert E. Jones, Jr., Jerry L. Guthrie, and Jacob L. Barber Apr. 1991 118 p
(AD-A235430; ARI-RN-91-43) Avail: NTIS HC/MF A06 CSCL 05/9

This handbook is a guide to the analysis of manpower, personnel, and training (MPT) topics as a part of a MANPRINT assessment. Some of the theory underlying Manpower and Personnel Integration (MANPRINT) and the technical and administrative steps in the MPT analysis are presented. The sequence of activities for conducting the MPT analysis, the rationale underlying those activities, and specific approaches to planning the MPT analysis are included. Also addressed are the topics of interviewing personnel and collecting data as well as sources of

data relevant to MPT aspects of system performance. A format for the MPT analysis report is provided. The handbook is illustrated with examples from the MPT analyses of three materiel acquisition programs. GRA

N91-28023# Department of Defense, Washington, DC. Directorate for Information Operations and Reports.
THE 500 CONTRACTORS RECEIVING THE LARGEST DOLLAR VOLUME OF PRIME CONTRACT AWARDS FOR RDT AND E, FISCAL YEAR 1990
1990 37 p
(AD-A235444; DIOR/P02-90; P02) Avail: NTIS HC/MF A03 CSCL 05/9

Summary data is presented on the 500 prime contractors receiving the largest dollar volume in Department of Defense (DoD) awards over $25,000 for research, development, test and evaluation (RDT and E) work during Fiscal Year (FY) 1990. RDT and E work can include research, exploratory development, advanced development, engineering development, operational systems development, or management and support services. Table 1 lists the 500 contractors in alphabetical order, shows the ranking for each, and shows how each has been categorized for reporting purposes. The categories are business firm (B), foreign contractor (F), and nonprofit institution (N). Table 2 shows the net value of awards to U.S. business firms by rank. Those firms which qualify as small businesses are further identified by an S. The net value of awards to each of the firm's reported locations is also provided. Tables 3, 4, and 5 provide the net value of awards to U.S. educational and other nonprofit institutions, foreign contractors, and U.S. government agencies. (While awards to U.S government agencies are listed separately in Table 5, these agencies are categorized as nonprofit institutions in Table 1.) As in Table 2, contractors in Tables 3 through 5 are shown by rank, with their total awards indicated by an asterisk. The next value of awards to each of the contractor's reported locations are also shown for these tables. GRA

N91-28024# Institute for Defense Analyses, Alexandria, VA.
CONCURRENT ENGINEERING TEAMS. VOLUME 1: MAIN TEXT
Karen J. Richter and David A. Dierolf Nov. 1990 56 p
(Contract MDA903-89-C-0003)
(AD-A236093; IDA-P-2516-Vol-1; IDA/HQ-90-36607; AD-E501383) Avail: NTIS HC/MF A04 CSCL 05/1

Specific concurrent engineering practices vary among organizations. There are, however, various management practices that appear to work well for most organizations. This paper presents the reader with specific, useful examples from several defense contractors illustrating how multifunctional concurrent engineering teams are being organized and managed and how concurrent engineering team meetings are conducted and supported. The types of computer support that could be used to enhance the efficiency and effectiveness of concurrent engineering team meetings are identified. The general findings are that there exists a direct relationship between total quality management (TQM) and concurrent engineering, and that many applications of computer-aided group problem solving are possible and practical today for the concurrent engineering team meetings. Areas identified for additional research are the documentation of the decision process and rationale during the product and process definition, the capturing of lessons learned during the implementation of concurrent engineering, and the performance evaluation and training of team members. GRA

N91-28025*# Carnegie-Mellon Univ., Pittsburgh, PA. Robotics Inst.
BALANCING ANTAGONISTIC TIME AND RESOURCE UTILIZATION CONSTRAINTS IN OVER-SUBSCRIBED SCHEDULING PROBLEMS
Stephen F. Smith and Dhiraj K. Pathak Mar. 1991 16 p
(Contract NCC2-531)
(NASA-CR-188677; NAS 1.26:188677; AD-A236643; CMU-RI-TR-91-05) Avail: NTIS HC/MF A03 CSCL 12/4

In this paper, we report work aimed at applying concepts of constraint-based problem structuring and multi-perspective scheduling to an over-subscribed scheduling problem. Previous research has demonstrated the utility of these concepts as a means for effectively balancing conflicting objectives in constraint-relaxable scheduling problems, and our goal here is to provide evidence of their similar potential in the context of HST observation scheduling. To this end, we define and experimentally assess the performance of two time-bounded heuristic scheduling strategies in balancing the tradeoff between resource setup time minimization and satisfaction of absolute time constraints. The first strategy considered is motivated by dispatch-based manufacturing scheduling research, and employs a problem decomposition that concentrates local search on minimizing resource idle time due to setup activities. The second is motivated by research in opportunistic scheduling and advocates a problem decomposition that focuses attention on the goal activities that have the tightest temporal constraints. Analysis of experimental results gives evidence of differential superiority on the part of each strategy in different problem solving circumstances. A composite strategy based on recognition of characteristics of the current problem solving state is then defined and tested to illustrate the potential benefits of constraint-based problem structuring and multi-perspective scheduling in over-subscribe scheduling problems. GRA

N91-28026*# National Aeronautics and Space Administration, Washington, DC.
ISSUES IN NASA PROGRAM AND PROJECT MANAGEMENT
Francis T. Hoban, ed. 1991 62 p
(NASA-SP-6101(04); NAS 1.21:6101(04)) Avail: NTIS HC/MF A04 CSCL 05A

This volume is the third in an ongoing series on aerospace project management at NASA. Articles in this volume cover the attitude of the program manager, program control and performance measurement, risk management, cost plus award fee contracting, lessons learned from the development of the Far Infrared Absolute Spectrometer (FIRAS), small projects management, and age distribution of NASA scientists and engineers. A section on resources for NASA managers rounds out the publication. Author

N91-28027# National Academy of Sciences - National Research Council, Washington, DC. Commission on Engineering and Technical Systems.
RESEARCH ON THE MANAGEMENT OF TECHNOLOGY: UNLEASHING THE HIDDEN COMPETITIVE ADVANTAGE Final Report
Apr. 1991 50 p Sponsored by NSF
(PB91-184085) Avail: NTIS HC/MF A03 CSCL 05A

A research agenda is outlined for industry, universities, the National Science Foundation, and the National Research Council, that addresses the need to increase rapidly the effectiveness of technological factors such as research, development, implementation, engineering, and manufacturing. It is crucial for these factors to be managed skillfully to maximize competitive advantage from both a business and a technological perspective. This is the domain of management of technology (MoT) a critical factor for assuring success in today's business world. Progress since 1987 has been mixed. The university/theoretical side of the field has grown slowly, while academe and industry have not specifically addressed many of the topics that were suggested in 1987, the communication gap between academe and industry remains large; and the limited results of research on MoT have not had a significant impact on improving America's Competitive situation. No substantive support has appeared among the federal agencies for MoT research, and support of MoT research by industry is sparse. GRA

N91-28028# National Academy of Sciences - National Research Council, Washington, DC. Office of Scientific and Engineering Personnel.
RECRUITMENT, RETENTION, AND UTILIZATION OF FEDERAL SCIENTISTS AND ENGINEERS Final Report, 1 Jul. 1989 - 31 Jul. 1990
A. K. Campbell and L. S. Dix Aug. 1990 187 p Sponsored by Carnegie Commission on Science, Technology and Government, NY
(PB91-179366; ISBN-0-309-04330-1; LC-90-62688) Avail: NTIS HC/MF A09 CSCL 05A

The report is the result of an exploratory study of the organizational and institutional processes that may affect the ability of federal government to attract and retain scientists and engineers. The study committee conducted a literature review; discussed relevant issues with Alan T. Watterman Awardees, directors of 22 federal laboratories, and college placement officers; commissioned papers; and met with representatives of approximately 25 federal agencies to determine factors influencing recruitment, retention, and utilization of scientists and engineers; organizational and decision-making processes that relate to them; and mechanisms undertaken to maintain a stable work force of scientists and engineers. The report focuses on the Central Personnel Data File (CPDF) maintained by the Office of Personnel Management (OPM), factors affecting the federal government's ability to recruit and retain scientists and engineers, specific efforts by OPM and individual federal agencies to enhance such recruitment and retention, science and engineering activity undertaken under a variety of scenarios, and the impact of political appointees on the fulfillment of federal science and engineering (S&E) work.
Author

N91-28029# Small Business Administration, Washington, DC. Office of Advocacy
TICKET TO TOMORROW: THE NATIONAL LEGISLATIVE 11TH CONFERENCE ON SMALL BUSINESS ISSUES
1990 376 p Conference held in Atlanta, GA, 10-12 Dec. 1990
(PB91-163378) Avail: NTIS HC/MF A17 CSCL 05A

The eleventh conference focuses on small business challenges in the 1990's and beyond. A number of social and demographic trends will affect America's business community in the next decade, among them, the shrinking work force, increasing international competition, affordability of health coverage, work force literacy, and AIDS. Small firms especially will feel the effects of these changes, as the work force becomes older and more culturally diverse. This collection of papers addresses these and other small business issues.
GRA

N91-27188# Joint Publications Research Service, Arlington, VA.
US EXPERIENCE CITED TO URGE CHANGE IN SPACE PROGRAM MANAGEMENT
Vladimir Terekhov *In its* JPRS Report: Science and Technology. USSR: Space 7 Feb. 1991 p 59-62 Transl. into ENGLISH from Sovetskaya Rossiya (Moscow, USSR), 22 Aug. 1990 p 2
(For primary document see N91-27183 19-18)
Avail: NTIS HC/MF A05

N91-28122*# Howard Univ., Washington, DC. Dept. of Electrical Engineering.
ENGINEERING MANAGEMENT OF LARGE SCALE SYSTEMS
Serita Sanders, Tepper L. Gill, and Arthur S. Paul *In* Alabama A & M Univ., NASA-HBCU Space Science and Engineering Research Forum Proceedings 1989 p 443-44 (For primary document see N91-28063 19-99)
Avail: NTIS HC/MF A23 CSCL 05A

82 DOCUMENTATION AND INFORMATION SCIENCE

Includes information management; information storage and retrieval technology; technical writing; graphic arts; and micrography.

For computer documentation see *61 Computer Programming and Software.*

N91-28030# National Inst. of Standards and Technology, Gaithersburg, MD.
NIST RESEARCH REPORTS, OCTOBER 1990
Oct. 1990 37 p
(PB91-112813; NIST/SP-797) Avail: NTIS HC/MF A03; also available SOD HC $1.75 as 003-003-03054-6 CSCL 05B

The following research reports are presented: (1) Four Companies Win Baldrige Award; (2) NIST, Industry Work Together for Automated Quality; (3) Seven R and D 100 Awards Go to NIST; (4) Teaching Machines their ABCs; (5) Technologies of the Future Identified; (6) To Measure a Molecule; (7) Key Industries Invest to Boost Quality; (8) No Evidence for Fifth Force Found; and (9) Tech Transfer Awards Announced. A research update, conference calendar, and section on new publications are also presented.
K.S.

N91-28031# RAND Corp., Santa Monica, CA. Publications Dept.
RAND'S CARTOGRAPHIC ANALYSIS AND GEOGRAPHIC INFORMATION SYSTEM (RAND-CAGIS): A GUIDE TO SYSTEM USE
A. L. Zobrist, L. J. Marcelino, and G. S. Daniels 1991 217 p
(RAND/N-3172-RC) Avail: NTIS HC/MF A10

RAND-CAGIS (RAND's Cartographic Analysis and Geographic Information System (GIS)) is a modular GIS capable of raster, vector, and tabular data manipulation. It was developed for use at RAND to support computer modeling and policy analysis research. The system utilizes NASA-Goddard's Transportable Applications Executive (TAE) host environment, and is currently implemented on Sun Microsystem workstation using Sun View and X11 windowing systems. RAND-CAGIS's role involves three main areas: (1) prepare geographic data for computer models; (2) facilitate the smooth exchange of data between models; and (3) perform supplementary calculations for these models. The most common use of RAND-CAGIS involves preparing and integrating data from various sources for use in computer modeling activities.
Author

N91-28032# Naval Postgraduate School, Monterey, CA. Dept. of Computer Science.
CLUSTERING, CONCURRENCY CONTROL, CRASH RECOVERY, GARBAGE COLLECTION, AND SECURITY IN OBJECT-ORIENTED DATABASE MANAGEMENT SYSTEMS
Everton G. dePaula and Michael L. Nelson 25 Feb. 1991 17 p
(AD-A235448; NPS-CS-91-008) Avail: NTIS HC/MF A03
CSCL 12/7

This paper presents considerations about several topics that have a direct influence on data reliability and performance in object oriented database management systems. These topics are: physical storage management (clustering), concurrency control, crash recovery, garbage collection, and database security. Each topic is illustrated by its application to the Tactical Database as designed for the Low Cost Combat Direction System.
GRA

N91-28033*# National Aeronautics and Space Administration. Langley Research Center, Hampton, VA.
NASA/DOD AEROSPACE KNOWLEDGE DIFFUSION RESEARCH PROJECT: THE DOD PERSPECTIVE Paper No. 7
Thomas E. Pinelli and John M. Kennedy 1 Nov. 1990 26 p Presented at the Defense Technical Information Center 1990 Annual Users Training Conference, Alexandria, VA Prepared in cooperation with Indiana Univ., Bloomington
(NASA-TM-101746; NAS 1.15:101746; AD-A235648) Avail: NTIS HC/MF A03 CSCL 05/2

This project will provide descriptive and analytical data

regarding the flow of STI at the individual, organizational, national, and international levels. It will examine both the channels used to communicate information and the social system of the aerospace knowledge diffusion process. Results of the project should provide useful information to R and D managers, information managers, and others concerned with improving access to and use of STI. Objectives include: (1) understanding the aerospace knowledge diffusion process at the individual, organizational, and national levels, placing particular emphasis on the diffusion of Federally funded aerospace STI; (2) understanding the international aerospace knowledge diffusion process at the individual and organizational levels, placing particular emphasis on the systems used to diffuse the results of Federally funded aerospace STI; (3) understanding the roles NASA/DoD technical report and aerospace librarians play in the transfer and use of knowledge derived from Federally funded aerospace R and D; (4) achieving recognition and acceptance within NASA, DoD and throughout the aerospace community that STI is a valuable strategic resource for innovation, problem solving, and productivity; and (5) providing results that can be used to optimize the effectiveness and efficiency of the Federal STI aerospace transfer system and exchange mechanism. GRA

N91-28034# Logistics Management Inst., Bethesda, MD.
DOD'S TECHNICAL INFORMATION PUBLISHING: A STRATEGY FOR EVOLUTION Final Report
Kenneth W. Lindstrom, Frank Gilbane, and James E. Giles, III Feb. 1991 42 p
(Contract MDA903-85-C-0139)
(AD-A235749; LMI-PL811R1) Avail: NTIS HC/MF A03 CSCL 05/2

Acquisition, publishing, and maintenance of technical information is vital to support weapon systems over their life cycles. The Military Departments use technical information to make tradeoff decisions during the weapon system acquisition process and to meet fielded system requirements for training, operation, and maintenance (preventive, corrective, rework, reprocurement, etc.). Technical information can cost as much as 20 percent of acquisition and support costs of new weapon systems. Technological changes sweeping the publishing industry enable a new approach for acquiring, publishing, and managing technical information. These changes include: advances in computers, improved information management, and the adoption by DoD and many of its suppliers of new international digital information exchange standards. In aggregate, we will refer to these changes and the new approach they mandate as digital Technical Information Publishing (TIP) - the dynamic organization, retrieval, and presentation of information in different media on demand. Adoption of TIP will facilitate greatly acquisition, distribution, and maintenance of DoD's technical information. This report addresses these problems. It discusses the state of publishing technology, describes a conceptual framework based on a technical information database that supports TIP, and concludes with recommendations for implementing TIP. GRA

N91-28035# Colorado Univ., Colorado Springs.
MANAGEMENT OF INFORMATION TECHNOLOGY ACCESS CONTROLS M.S. Thesis
Michael R. Pollack 1991 118 p
(AD-A236275) Avail: NTIS HC/MF A06 CSCL 12/7

System access control directs, regulates, and coordinates the logical, physical, and administrative protection capabilities pertaining to interactions with an information system (IS). System access control, a subset of information technology (IT) and general business controls, are IS security's critical first line of defense. It has traditionally progressed by increasing the speed and memory, and decreasing the size of centralized IS. However, recent movements toward distributed IS and the accompanying architectural changes present new management challenges, especially in the area of controlling system access. Distributed IS magnifies potential control problems because it relies upon inherently less secure hardware and software, and increases potential system access points through local and telecommunication interconnection. However, the biggest threat to system access control is found within the organization's own workforce. These issues motivated the development of an Access Control Management Model. GRA

N91-28036# Institute for Perception RVO-TNO, Soesterberg (Netherlands).
AN EXPLORATORY STUDY OF THE INTERPRETATION OF LOGICAL OPERATORS IN DATABASE QUERYING Final Report
P. J. Essens, C. A. McCann, and M. A. Hartevelt 22 Mar. 1991 31 p
(AD-A236478; IZF-1991-B-2; TDCK-TD91-0043) Avail: NTIS HC/MF A03 CSCL 12/5

The use of logical operators in query languages is considered to be a major source of user problems in database querying. The present study investigated whether people untrained in logic could successfully interpret logical operators; and, how errors and latencies are related to the structure of the query. In an experiment, the logical complexity of an SQL-style query formulation was varied in using AND, OR, and NOT operators in either single or combined form. The latency and error data converged to show that subjects had increasing difficulty with queries constructed with a combination of different operators. The inclusion of brackets had a strong positive effect on task performance. Verbal protocols were used to identify sources of errors in query processing. A model of query processing was formulated and predictions latencies and errors on the basis of processing components were tested. GRA

N91-28037# North Carolina Univ., Chapel Hill. Dept. of Computer Science.
SEARCH IMPROVEMENT VIA AUTOMATIC QUERY REFORMULATION
Susan Gauch and John B. Smith Feb. 1991 33 p
(Contract N00014-86-K-0680)
(AD-A236588; TR91-010) Avail: NTIS HC/MF A03 CSCL 12/7

Users of online retrieval systems experience many difficulties, particularly with search tactics. User studies have indicated that searchers use vocabulary incorrectly and do not take full advantage of iteration to improve their queries. To address these problems, an expert system for online search assistance was developed. This prototype augments the searching capabilities of novice users by providing automatic query reformulation to improve the search results, and automatic ranking of the retrieved passages to speed the identification of relevant information. Users' search performance using the expert system was compared with their search performance on their own, and their search performance using an online thesaurus. The following conclusions were reached: (1) the expert system significantly reduced the number of queries necessary to find relevant passages compared with the user searching alone or with the thesaurus; (2) the expert system produced marginally significant improvements in precision compared with the user searching on their own. There was no significant difference in the recall achieved by the three system configurations; and (3) overall, the expert system ranked relevant passages above irrelevant passages. GRA

N91-28038# Defense Logistics Agency, Alexandria, VA.
ADVANCED METHODS OF ONLINE SEARCHING FOR ARTIFICIAL INTELLIGENCE INFORMATION Final Report
Mott Given May 1991 12 p
(AD-A236653) Avail: NTIS HC/MF A03 CSCL 12/7

A tremendous amount of information on artificial intelligence is available online via different computer networks. This paper will discuss resources available via USENET, INTERNET, BITNET, and other sources that allow information to be shared electronically on a worldwide basis. It will be shown how these networks are used in discussion groups, mailing lists, file transfers, mailservers, and databases. GRA

N91-28039# Defense Logistics Agency, Alexandria, VA.
INFORMATION RESOURCES MANAGEMENT ENVIRONMENT VISION AND PRESCRIPTION, VERSION 1.1
Robert J. Knez Apr. 1991 83 p
(AD-A236846) Avail: NTIS HC/MF A05 CSCL 12/7

This paper outlines a vision for DLA's IRM environment in the mid-1990s and beyond. It prescribes a re-engineered data, process, technology, and organizational environment intended to facilitate sharing of data, manufacturing of information systems components and the assembly of applications to a customer's order. Its tenets are achieved through a single image corporate data model of subject data bases, business process foundation modules, design to the State-of-the-Contract technology policy, extensive use of information engineering and repository methodology, central development and maintenance of application components, distributed application assembly, open systems, and cooperative processing. It recognizes the need to make several paradigm shifts and prescribes alternative migration strategies including fresh start and cross model resolution evolutionary approaches. GRA

N91-28040# Naval Ocean Systems Center, San Diego, CA.
A SCENARIO-BASED METHODOLOGY FOR EVALUATING USER INTERFACE FUNCTIONALITY ON A DATABASE RETRIEVAL TASK
Kathleen Fernandes May 1991 6 p
(AD-A236967) Avail: NTIS HC/MF A02 CSCL 23/2

The current study developed a methodology that attempts to link ease and accuracy in user interface operation to system output and utility. A problem solving task is broken into four components: problem, interface, output, and user decision. With this methodology, a problem is presented and then data are collected on the operation of each of the remaining components. These data can be used to determine (1) if a user interface produces the system output and/or user decision expected or desired, and (2) if alternative interface designs have a differential impact on the system output and/or user decision. GRA

N91-28041*# National Aeronautics and Space Administration, Washington, DC.
NASA COMBINED FILE POSTINGS STATISTICS BASED ON NASA THESAURUS, JANUARY 1968 - JANUARY 1991
Jan. 1991 349 p
(NASA-CR-188666; NAS 1.26:188666) Avail: NTIS HC/MF A15 CSCL 05B

The NASA Combined File Postings Statistics is published semiannually (January and July). This alphabetical listing of postable subject terms contained in the NASA Thesaurus is used to display the number of postings (documents) indexed by each subject term from 1968 to data. The postings totals per term are separated by announcement or other media into STAR, IAA, NLN, and OTHER columnar entries covering the NASA document collection (1968 to date). Over 595,000 book postings for NALNET Books held by NASA Libraries are included under the NLN column. CSTAR postings as well as some previously unreported series are listed under the 'other' column. The distribution of 18,748,083 postings among the 17,304 Thesaurus terms is tabulated on the last page of Combined File Postings Statistics. Author

N91-28042* National Aeronautics and Space Administration, Washington, DC.
NASA PATENT ABSTRACTS BIBLIOGRAPHY: A CONTINUING BIBLIOGRAPHY. SECTION 1: ABSTRACTS (SUPPLEMENT 39)
Jul. 1991 63 p
(NASA-SP-7039(39)-Sect-1; NAS 1.21:7039(39)-Sect-1) Avail: NTIS HC A04; NTIS standing order as PB89-911100, $13.75 domestic, $27.50 foreign CSCL 05B

Abstracts are provided for 154 patents and patent applications entered into the NASA scientific and technical information systems during the period Jan. 1991 through Jun. 1991. Each entry consists of a citation, an abstract, and in most cases, a key illustration selected from the patent or patent application. Author

N91-28043*# National Inst. of Standards and Technology, Gaithersburg, MD.
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION'S (NASA) AUTOMATED INFORMATION SECURITY HANDBOOK
E. Roback Mar. 1991 107 p
(NASA-CR-188682; NAS 1.26:188682; PB91-187781; NISTIR-4518; NHB-2410.9) Avail: NTIS HC/MF A06 CSCL 05B

The NASA Automated Information Security Handbook provides NASA's overall approach to automated information systems security including discussions of such aspects as: program goals and objectives, assignment of responsibilities, risk assessment, foreign national access, contingency planning and disaster recovery, awareness training, procurement, certification, planning, and special considerations for microcomputers. Author

N91-28044# Office of Management and Budget, Washington, DC. Statistical Policy Office.
SEMINAR ON QUALITY OF FEDERAL DATA, PARTS 1-3
Mar. 1991 474 p Seminar held 23-24 May 1990
(PB91-142414; STATISTICAL-POLICY-WP-20) Avail: NTIS HC/MF A20 CSCL 05B

Statistical Policy Working Paper 20, published in three parts, presents the proceedings of the Seminar on Quality and Federal Data. The following topics are covered: (1) survey quality profiles; (2) paradigm shifts using administrative records; (3) survey coverage evaluation; (4) telephone data collection; (5) data editing; (6) computer assisted statistical surveys; (7) quality in business surveys; (8) cognitive laboratories; (9) employer reporting unit match study; (10) approaches to developing questionnaires; (11) statistical disclosure avoidance; (12) Federal longitudinal surveys; and (13) towards an agenda for the future. GRA

N91-28045# National Inst. of General Medical Sciences, Bethesda, MD.
NATIONAL INSTITUTE OF GENERAL MEDICAL SCIENCES PUBLICATIONS LIST, FEBRUARY 1990
Feb. 1990 8 p
(PB91-163394) Avail: NTIS HC/MF A02 CSCL 05B

The publications list from the National Institute of General Medical Sciences (NIGMS) includes currently available reports, catalogs, grant information, facts sheets, and topical articles. Article titles include: (1) Choose a Career on the Science Frontier; (2) Genetic Disease Special Report 1988; (3) Inside the Cell; (4) Medicines and You; (5) The New Human Genetics: How Gene Splicing Helps Researchers Fight Inherited Diseases; and (6) The Sculptures of Life: Discovering the Molecular Shapes that Determine Health or Disease. Information on recent research advances by NIGMS grantees is also provided. GRA

N91-28046# Institute for Scientific Information, Inc., Philadelphia, PA.
BIBLIOMETRICS OF BASIC RESEARCH
H. Small Jul. 1990 78 p
(PB91-166579; PB91-166561) Avail: NTIS HC/MF A05; also avail. in set of 8 reports, HC/MF(en1) E99 as PB91-166561 CSCL 05B

As part of its project, Basic Research for the 1990's, the Office of Technological Assessment (OTA) is attempting to construct an information baseline of the scientific research enterprise in the United States. The baseline will be used to assess developments in the coming decade. Citation is one of the principal mechanisms for recognizing the work of others for its utility or relevance to ones work. References are a common feature of scientific publications, and by counting how often publications are cited, bibliometrics can arrive at a weighted measure of publication output, which counts not only whether publications have been produced but what impact those publications have had on the work of other scientists. The project involved two general tasks: to generate bibliometric profiles for the United States academic institutions which would reflect changes in the impact of basic research carried out at these institutions; and to devise new kinds of bibliometric

indicators which would help characterize the basic research enterprise in the United States. GRA

N91-28074*# Jackson State Univ., MS. Dept. of Computer Science.
IMAGE DATABASES: PROBLEMS AND PERSPECTIVES
V. Naidu Gudivada *In* Alabama A & M Univ., NASA-HBCU Space Science and Engineering Research Forum Proceedings 1989 p 53-60 (For primary document see N91-28063 19-99)
(Contract DE-FG05-86ER-75274)
Avail: NTIS HC/MF A23 CSCL 05B

N91-28081*# National Aeronautics and Space Administration. Earth Resources Lab., Bay Saint Louis, MS.
A STUDY OF SPATIAL DATA MANAGEMENT AND ANALYSIS SYSTEMS
Clyde Christopher (Jackson State Univ., MS.) and Richard Galle *In* Alabama A & M Univ., NASA-HBCU Space Science and Engineering Research Forum Proceedings 1989 p 101-10 (For primary document see N91-28063 19-99)
Avail: NTIS HC/MF A23 CSCL 05B

83 ECONOMICS AND COST ANALYSIS

Includes cost effectiveness studies.

No abstracts in this category.

84 LAW, POLITICAL SCIENCE AND SPACE POLICY

Includes NASA appropriation hearings; aviation law; space law and policy; international law; international cooperation; and patent policy.

N91-28047# Committee on Science, Space and Technology (U.S. House).
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION MULTIYEAR AUTHORIZATION ACT OF 1991
George E. Brown, Jr. Washington GPO 25 Apr. 1991 72 p Report to accompany H.R. 1988 presented by the Committee on Science, Space and Technology, 101st Congress, 1st Session, 25 Apr. 1991
(H-Rept-102-41; GPO-49-006) Avail: Document Room, House of Representatives, Washington, DC, 20515 HC free

This report, submitted by the House Committee on Science, Space, and Technology, reviews the bill (H.R. 1988) to authorize appropriations to NASA for fiscal years 1992, 1993, and 1994, and to the Department of Transportation Office of Commercial Space Transportation, the Department of Commerce Office of Space Commerce, and the National Space Council within the Executive Office of the President. The bill authorizes appropriations to NASA for research and development; space flight, control, and data communications; construction of facilities; research and program management; and for other purposes. The bill also sets forth special policy provisions and authorities in order to carry out the activities of the civil space program. The report reflects favorably upon the bill with an amendment and recommends the bill as amended to pass. Author

N91-28048# Committee on Commerce, Science, and Transportation (U.S. Senate).
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION AUTHORIZATION ACT, FISCAL YEAR 1992
Ernest F. Hollings Washington GPO Jul. 1991 49 p Presented by the Committee on Commerce, Science, and Transportation, 102d Congress, 1st Session, H. R. 1988, 2 Jul. 1991
(S-Rept-102-97; GPO-49-010) Avail: Committee on Commerce, Science, and Transportation, Senate, Washington, DC 20510 HC free

The purpose of this bill is to authorize appropiations to the National Aeronautics and Space Administration for research and development; space flight, control, and data communications; construction of facilities; research and program management; and the Inspector General. B.G.

N91-28049# Federal Aviation Administration, Washington, DC.
FEDERAL AVIATION REGULATIONS. PART 1: DEFINITIONS AND ABBREVIATIONS, CHANGE 14
4 Feb. 1991 23 p
(PB91-176644) Avail: NTIS HC/MF A03 CSCL 05D

The final rule upgrades the airworthiness standards for normal, utility, acrobatic, and commuter category airplanes. The amendment provides airworthiness standards for advancements in technology being incorporated in current designs, permits type certification of spin resistant airplanes, and reduces the regulatory burden in showing compliance with some of the requirements for the design and type certification of small airplanes. These new and amended airworthiness standards also result in the need for new definitions. As a result, new definitions are added. These amendments are necessary to ensure that the regulations reflect current industry practices. GRA

85 URBAN TECHNOLOGY AND TRANSPORTATION

Includes applications of space technology to urban problems; technology transfer; technology assessment; and surface and mass transportation.

For related information see also *03 Air Transportation and Safety, 16 Space Transportation,* and *44 Energy Production and Conversion.*

No abstracts in this category.

88 SPACE SCIENCES (GENERAL)

No abstracts in this category.

89 ASTRONOMY

Includes radio, gamma-ray, and infrared astronomy, and astrometry.

N91-28050*# Georgia State Univ., Atlanta. Dept. of Physics and Astronomy.
TOMOGRAPHIC SEPARATION OF COMPOSITE SPECTRA. THE COMPONENTS OF PLASKETT'S STAR
William G. Bagnuolo, Jr., Douglas R. Gies, and Michael S. Wiggs 1991 36 p
(Grants NAG5-1218; NSF AST-89-16110)
(NASA-CR-184665; NAS 1.26:184665) Avail: NTIS HC/MF A03 CSCL 03A

The UV photospheric lines of Plaskett's Star (HD 47129), a 14.4 day period, double lined O-type spectroscopic binary were analyzed. Archival data from IUE (17 spectra well distributed in orbital phase) were analyzed with several techniques. A cross correlation analysis, which showed that the secondary produces significant lines in the UV, indicates that the mass ratio is q = 1.18 + or - 0.12 (secondary slightly more massive). A tomography

algorithm was used to produce the separate spectra of the two stars in six spectral regions. The interpolated spectral classifications of the primary and secondary, 07.3 I and 06.2 I, respectively, were estimated through a comparison of UV line ratios with those in spectral standard stars. The intensity ratio of the stars in the UV is 0.53 + or - 0.05 (primary brighter). The secondary lines appear rotationally broadened, and the projected rotational velocity V sin i for this star is estimated to be 310 + or - 20 km/s. The possible evolutionary history of this system is discussed through a comparison of the positions of the components and evolutionary tracks in the H-R diagram. Author

N91-28051*# Washington Univ., Seattle. Dept. of Astronomy.
THE ULTRAVIOLET SPECTRUM OF HH 24A AND ITS RELATION TO OPTICAL SPECTRA
K. H. Boehm, A. Noriega-Crespo, J. Solf, and E. W. Brugel (Colorado Univ., Boulder.) 1991 27 p Sponsored in part by NASA, ESA, and Science Research Council of the UK
(Grant NAG5-45)
(NASA-CR-188649; NAS 1.26:188649) Avail: NTIS HC/MF A03 CSCL 03A

The spectrum of the brightest part (HH 24A) of the complex Herbig-Haro object HH 24 in the short wavelength UV range was studied. The object is of special interest since it is known that in the optical range the continuum is due to dust scattered light originating in a young stellar object while the shock excited emission lines are formed in HH 24A itself. The spectrum shows only a continuum or a quasi-continuum and is not comparable to that of the typical high excitation object like HH1 or HH2 nor to that of a low excitation object like HH3 or HH47. Author

N91-28052# Massachusetts Inst. of Tech., Lexington. Lincoln Lab.
LWIR STELLAR CALIBRATION: INFRARED SPECTRAL CURVES FOR 30 STANDARD STARS
Charles W. Engelke 10 Apr. 1991 131 p
(Contract F19628-90-C-0002)
(AD-A236766; TR-908; ESD-TR-90-143) Avail: NTIS HC/MF A07 CSCL 03/2

Best estimate spectral energy distributions are created for approximately 30 stars by fitting theoretically expected spectral curves to the available empirical flux data on the stars at a variety of wavelengths. The curves can be integrated over the band response functions for a given sensor in order to produce broadband power predictions against which to calibrate. GRA

N91-28053# Air Force Geophysics Lab., Hanscom AFB, MA.
CORRELATIONS BETWEEN LEVELS FOR STELLAR-SCINTILLOMETER-DERIVED PROFILES OF Cn SQ
Frank P. Battles and Edmund A. Murphy 10 Aug. 1990 32 p
(Contract F49620-88-C-0053; AF Proj. 7676)
(AD-A236927; GL-TR-90-0213; GL-SR-262) Avail: NTIS HC/MF A03 CSCL 04/1

A stellar scintillometer measures the variance of stellar intensity for a first magnitude or greater star. This variance can be converted, by the use of spatial filters, into a profile of (c sub n) -sq, the index of refraction structure constant, for 7 different altitudes or levels. The (c sub n) -sq values are not entirely instrument independent because there will be some overlap in the weighting functions used to separate the spatial frequencies. It is usually assumed that readings from levels 1, 4, and 7 are instrument independent. When linear correlation coefficients are calculated between levels for (c sub n) -sq and Log (c sub n) -sq of this data set, results obtained seem to contradict the above stated assumption. Much less correlation is observed when calculated on a nightly basis. In fact, some nightly coefficients are significantly negative, which could not be due to weighting function overlap. We have investigated other mechanisms which could lead to a high degree of correlation across the entire data set. During the measurement program, atmospheric conditions changed from evening to evening. For example, the jet stream passed through several times affecting the entire altitude range of the scintillometer. Correlation studies do not indicate that, except for low lying adjacent levels, (c sub n) -sq values obtained using the scintillometer are instrument dependent. GRA

N91-27184# Joint Publications Research Service, Arlington, VA.
SCIENTISTS' DISCOVERIES ON QUASARS, SUPERNOVAS NOTED
Veronika Romanenkova and Andrey Surzhanskiy *In its* JPRS Report: Science and Technology. USSR: Space 7 Feb. 1991 p 21-22 Transl. into ENGLISH from TASS (Moscow, USSR), 16 Nov. 1990 (For primary document see N91-27183 19-18)
Avail: NTIS HC/MF A05

N91-27185# Joint Publications Research Service, Arlington, VA.
RT-70 MILLIMETER RADIOTELESCOPE
L. M. Gindilis *In its* JPRS Report: Science and Technology. USSR: Space 7 Feb. 1991 p 22-27 Transl. into ENGLISH from Zemlya I Vselennaya (Moscow, USSR), no. 4, Jul. - Aug. 1990 p 26-31 (For primary document see N91-27183 19-18)
Avail: NTIS HC/MF A05

90 ASTROPHYSICS

Includes cosmology; celestial mechanics; space plasmas; and interstellar and interplanetary gases and dust.
For related information see also *75 Plasma Physics.*

N91-28054# Los Alamos National Lab., NM.
GROUND STATE GAMOW-TELLER STRENGTH IN Ni-64(n,p)Co-64
A. Ling, R. C. Haight, N. S. P. King, P. W. Lisowski, D. S. Sorenson, J. L. Ullmann, X. Aslanoglou, R. W. Finlay, B. K. Park, and J. Rapaport (Ohio Univ., Athens.) et al 1991 6 p Presented at the International Conference on Spin and Isospin in Nuclear Interactions, Telluride, 11-15 Mar. 1991
(Contract W-7405-eng-36)
(DE91-011437; LA-UR-91-1320; CONF-9103165-2) Avail: NTIS HC/MF A02

An important process occurring in presupernova stars is e(-) capture on free protons and nuclei. As e(-) capture and the charge exchange reaction (n,p) between same initial and final states are both T(sub 0) yields T(sub 0) + 1 transitions involving the same nuclear matrix element, the (n,p) reaction can be used to provide the input required to calculate e(-) capture rates. Specifically, the e(-) capture rate lambda(sup if) for a nucleus going from an initial state i to a final state f is proportional to the Gamow-Teller strength B(sup if)(GT). Once B(sup if)(GT) for a particular transition is known, the corresponding e(-) capture rate lambda(sup if) for that transition can be calculated. The unit cross section (cflx (sigma))(sub GT)(E,A) relates B(sup if) to the zero degree differential cross section extrapolated to q=0 for (n,p) or (p,n) reactions: sigma(q=0) = (cflx (sigma))(E,A)B(sup if)(GT). As (cflx (sigma))(E,A) has been seen to have a smooth A dependence, measurements of zero degree (n,p) cross sections for (fp) shell nuclei can be used to obtain B(sup if), and thus lambda (sup if), once a value for (cflx (sigma))(E,A) in this mass region is known. The data presented here allow a value for (cflx (sigma))(sub GT) in the (fp) shell to be calculated from the Gamow-Teller strength for the beta(-) decay Co-64(g.s.) yields Ni-64(g.s.) + e(-) + (e antineutrino). Since Co-64(g.s.) beta(-) decay and the reaction Ni-64(n,p) Co-64 (g.s.) have opposite initial and final states, detailed balance can be used to relate the Gamow-Teller strengths for the two processes: B(sup np)(GT) = 0.6228(sub -0.0369)(sup +.0328). It is this value of B(sup np) together with the differential cross section measurements presented here for the reaction Ni-64(n,p) Co-64(g.s.) that allow (cflx (sigma)) to be calculated and thus a calibration point in the (fp) shell is established. DOE

N91-28055# Northwestern Univ., Evanston, IL. Dept. of Physics and Astronomy.
SMM OBSERVATIONS OF INTERSTELLAR Al-26 Status Report

W. R. Purcell, M. P. Ulmer, G. H. Share, and R. L. Kinzer 1988 8 p
(Contract N00173-85-C-2501)
(AD-A236222) Avail: NTIS HC/MF A02 CSCL 03/2

The discovery of radioactive Al-26 in the interstellar medium has provided direct evidence for the recent nucleosynthesis of intermediate-mass nuclei in the Galaxy. While modern nucleosynthesis theories suggest that Al-26 production may occur in a variety of astrophysical objects, they have not been able to identify the dominant production site of the observed Al-26. Observationally, the greatest hope for identifying its source is through a comparison of the angular distribution of the 1.809 MeV radiation, emitted during the decay of Al-26, with the angular distributions of the suggested production sites. Limits on the distribution of the 1.809 MeV radiation have been obtained from data collected by the Solar Maximum Mission Gamma-Ray Spectrometer by using the Earth as an occulting disk in its large field-of-view. These limits are: (1) the data are inconsistent with a point source origin of 1.809 MeV radiation located at l=0 deg, b=0 deg at the 4.7 sigma confidence level; (2) the angular diameter for a uniform face-on disk distribution centered at l=0 deg, b=0 deg is greater than 10 deg at the 4.1 sigma confidence level; and (3) the data are consistent with each of the diffuse distribution models studied representing Al-26 production by many individual events occurring throughout the Galaxy. GRA

N91-28056# Wyoming Univ., Laramie. Dept. of Physics and Astronomy.
A STUDY OF THE ANGULAR DIAMETERS OF DUST SHELLS AROUND RED GIANTS Final Report, 1 Nov. 1987 - 31 Oct. 1990
H. M. Dyck and J. A. Benson 7 May 1991 35 p
(Grant AF-AFOSR-0057-88; AF Proj. 2311)
(AD-A236228; AFOSR-91-0526TR) Avail: NTIS HC/MF A03 CSCL 03/2

A summary of observations of the angular diameters of the shells around evolved red giants is reported. Many of these sources are partially resolved with a ground based 2.4 m telescope. The 8 to 13 micron spectral range was examined because this corresponds to the emission excesses observed in the spectra of oxygen-rich stars. These excesses are commonly thought to arise from small silicate mineral grains in the circumstellar shells. The shell structure was fully resolved for the bright supergiant alpha Orionis. A study of the results shows that the opacity of the silicate mineral grains around that star is similar to that inferred for other evolved stars and for the Trapezium. GRA

N91-28057# Department of the Navy, Washington, DC.
METHOD OF SIMULTANEOUSLY MEASURING ORTHOMETRIC AND GEOMETRIC HEIGHTS Patent Application
Alan G. Evans, inventor (to Navy) 26 Feb. 1991 13 p
(AD-D014913; US-Patent-Appl-SN-661352) Avail: NTIS HC/MF A03 CSCL 17/7

This invention relates generally to the measurement of geodetic quantities and more particularly to a method of simultaneously measuring orthometric and geometric heights. Knowledge of the vertical deflection of the gravity vector has great utility in various inertial navigation and/or geodetic applications. Conventional procedures to determine the two dimensional deflection of the gravity vector require the use of a theodolite for stellar observations and clear night time weather conditions. Therefore, this procedure is sensitive to environmental conditions. GRA

N91-28103*# Morgan State Univ., Baltimore, MD. Dept. of Physics.
MOESSBAUER SPECTROSCOPY AND SCANNING ELECTRON MICROSCOPY OF THE MURCHISON METEORITE
Christopher L. Brown, Frederick W. Oliver, and Ernest C. Hammond, Jr. *In* Alabama A & M Univ., NASA-HBCU Space Science and Engineering Research Forum Proceedings 1989 p 294-29 (For primary document see N91-28063 19-99)
Avail: NTIS HC/MF A23 CSCL 03B

N91-28104*# Tennessee State Univ., Nashville. Dept. of Mechanical Engineering.
SOLVING THE BM CAMELOPARDALIS PUZZLE
Mathias Teke, Michael R. Busby, and Douglas S. Hall (Vanderbilt Univ., Nashville, TN.) *In* Alabama A & M Univ., NASA-HBCU Space Science and Engineering Research Forum Proceedings 1989 p 298-30 (For primary document see N91-28063 19-99)
(Grants NAG8-111; NSF AST-84-14594)
Avail: NTIS HC/MF A23 CSCL 03B

91 LUNAR AND PLANETARY EXPLORATION

Includes planetology; and manned and unmanned flights.

For spacecraft design or space stations see *18 Spacecraft Design, Testing and Performance.*

N91-28101*# Morgan State Univ., Baltimore, MD. Dept. of Physics.
AN ANALYSIS OF THE MOON'S SURFACE USING REFLECTED ILLUMINATION FROM THE EARTH DURING A WANING CRESCENT LUNAR PHASE
Ernest C. Hammond, Jr. and Maggie Linton-Petza *In* Alabama A & M Univ., NASA-HBCU Space Science and Engineering Research Forum Proceedings 1989 p 276-28 (For primary document see N91-28063 19-99)
Avail: NTIS HC/MF A23 CSCL 03B

92 SOLAR PHYSICS

Includes solar activity, solar flares, solar radiation and sunspots.

For related information see *93 Space Radiation.*

N91-28058# Los Alamos National Lab., NM.
FIRST RESULTS FROM THE SOVIET-AMERICAN GALLIUM EXPERIMENT
A. I. Abazov, D. N. Abdurashitov, O. L. Anosov, L. A. Eroshkina, E. L. Faizov, V. N. Gavrin, A. V. Kalikhov, T. V. Knodel, I. I. Knyshenko, and V. N. Kornoukhov (Academy of Sciences, USSR, Moscow) et al 1990 11 p Presented at the 14th International Conference on Neutrino Physics and Astrophysics, Neutrino 90, Cern (Switzerland), 10-15 Jun. 1990
(Contract W-7405-eng-36)
(DE91-011384; LA-UR-91-1251; CONF-9006276-3) Avail: NTIS HC/MF A03

The Soviet-American Gallium Experiment is the first experiment able to measure the dominant flux of low energy p-p solar neutrinos. Four extractions made during January to May 1990 from 30 tons of gallium have been counted and indicate that the flux is consistent with 0 SNU and is less than 72 SNU (68 percent CL) and less than 138 SNU (95 percent CL). This is to be compared with the flux of 132 SNU predicted by the Standard Solar Model. DOE

93 SPACE RADIATION

Includes cosmic radiation; and inner and outer earth's radiation belts.

For biological effects of radiation see *52 Aerospace Medicine.* For theory see *73 Nuclear and High-Energy Physics.*

N91-28059*# Louisiana State Univ., Baton Rouge. Dept. of Physics and Astronomy.
COSMIC RAY POSITRON RESEARCH AND SILICON TRACK DETECTOR DEVELOPMENT Final Technical Report, 1 Dec. 1987 - 30 Nov. 1990
W. Vernon Jones and John P. Wefel 1991 27 p
(Grant NAGw-1247)

(NASA-CR-187708; NAS 1.26:187708) Avail: NTIS HC/MF A03 CSCL 03B

The purpose was to conduct research on: (1) position sensing detector systems, particularly those based upon silicon detectors, for use in future balloon and satellite experiments; and (2) positrons, electrons, proton, anti-protons, and helium particles as measured by the NASA NMSU Balloon Magnet Facility. Author

99 GENERAL

N91-28060*# National Aeronautics and Space Administration, Washington, DC.

FIRST AMONG EQUALS: THE SELECTION OF NASA SPACE SCIENCE EXPERIMENTS

John E. Naugle 1990 145 p

(NASA-SP-4215; NAS 1.21:4215) Avail: NTIS HC/MF A07 CSCL 05D

The process is recounted by which NASA and the scientific community have, since 1958, selected individual experiments for NASA space missions. It explores the scientific and organizational issues involved in the selection process and discusses the significance of the process in the character and accomplishments of U.S. space activities. Author

N91-28061# Air Force Office of Scientific Research, Bolling AFB, Washington, DC.

AIR FORCE OFFICE OF SCIENTIFIC RESEARCH TECHNICAL REPORT SUMMARIES: OCTOBER-DECEMBER 1990 Quarterly Report

Debra L. Tyrrell Dec. 1990 198 p

(AD-A234832; AFOSR-91-0217TR) Avail: NTIS HC/MF A09 CSCL 05/2

The AFOSR (Air Force Office of Scientific Research) Technical Report Summaries are published quarterly of each calendar year. They consist of a brief summary of each AFOSR technical report received in the Technical Information Division and submitted to the Defense Technical Information Center for that quarter. GRA

N91-28062# Air Force Office of Scientific Research, Bolling AFB, Washington, DC.

AIR FORCE OFFICE OF SCIENTIFIC RESEARCH: RESEARCH PROPOSAL QUARTERLY STATUS REPORT Quarterly Status Report, Oct. - Dec. 1990

Debra L. Tyrrell Jan. 1991 49 p

(AD-A234833; AFOSR-91-0218TR) Avail: NTIS HC/MF A03 CSCL 05/1

The AFOSR Research Proposal Quarterly Status Report is published quarterly of each calendar year. It lists all the research proposals received by AFOSR in the previous six months along with the action taken (Initiated, Declined or Withdrawn) on each report. The report is divided into two parts. The Institution index lists proposals alphabetically by institution. This is followed by a more detailed listing by Directorate, and by Program Manager within the Directorate. Author

N91-28063*# Alabama A & M Univ., Huntsville.

NASA-HBCU SPACE SCIENCE AND ENGINEERING RESEARCH FORUM PROCEEDINGS

Yvonne D. Sanders, ed., Yvonne B. Freeman, ed. (National Aeronautics and Space Administration, Washington, DC.), and M. C. George, ed. 1989 536 p Forum held in Huntsville, AL, 22-23 Mar. 1989 Sponsored in part by NASA, Washington; and by Historically Black Colleges and Universities (HBCU)

(NASA-CR-188650; NAS 1.26:188650) Avail: NTIS HC/MF A23 CSCL 05B

The proceedings of the Historically Black Colleges and Universities (HBCU) forum are presented. A wide range of research topics from plant science to space science and related academic areas was covered. The sessions were divided into the following subject areas: Life science; Mathematical modeling, image processing, pattern recognition, and algorithms; Microgravity processing, space utilization and application; Physical science and chemistry; Research and training programs; Space science (astronomy, planetary science, asteroids, moon); Space technology (engineering, structures and systems for application in space); Space technology (physics of materials and systems for space applications); and Technology (materials, techniques, measurements). For individual titles, see N91-28064 through N91-28127.

N91-28064*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, CA.

A COMPARATIVE STUDY OF SEMINIFEROUS TUBULAR EPITHELIUM FROM RATS FLOWN ON COSMOS 1887 AND SL3 **c51**

Walter J. Sapp, Carol S. Williams, K. Kato, Delbert E. Philpott, J. Stevenson, and L. V. Serova (Institute of Biomedical Problems, Moscow, USSR) *In* Alabama A & M Univ., NASA-HBCU Space Science and Engineering Research Forum Proceedings 1989 p 1-8 Submitted for publication Sponsored in part by NIH (For primary document see N91-28063 19-99)

(Contracts NCC2-12; NCC2-455)

Avail: NTIS HC/MF A23 CSCL 06C

Space flight, with its unique environmental constraints such as immobilization, decreased and increased pressures, and radiation, is known to affect testicular morphology and spermatogenesis. Among the several biological experiments and animals on board COSMOS 1887 Biosputnik flight were 10 rats, from which were collected testicular tissue. Average weights of flight tests were 6.4 pct. below that of the vivarium control when normalized for weight loss/100 grams body weight. Counts of surviving spermatogonia per tubule cross section indicated an average of 39 spermatogonia for flight animals, 40 for synchronous controls and 44 for the vivarium controls. Serum testosterone was significantly decreased when compared to basal controls but the decrease was not significant when compared in vivarium and synchronous control groups. The significant decrease in spermatogonia and the decrease in serum testosterone are similar to that in animals flown on Space Lab 3 (Challenger Shuttle). Author

N91-28065*# Tuskegee Inst., AL. Agricultural Experiment Station.

EFFECT OF BIWEEKLY SHOOT TIP HARVESTS ON THE GROWTH AND YIELD OF GEORGIA JET SWEET POTATO GROWN HYDROPONICALLY **c51**

Cyriacus R. Ogbuehi, Phil A. Loretan, C. K. Bonsi, Walter A. Hill, Carlton E. Morris, P. K. Biswas, and Desmond G. Mortley *In* Alabama A & M Univ., NASA-HBCU Space Science and Engineering Research Forum Proceedings 1989 p 9-14 Sponsored in part by Department of Agriculture (For primary document see N91-28063 19-99)

(Grant NAG10-24)

Avail: NTIS HC/MF A23 CSCL 06C

Sweet potato shoot tips have been shown to be a nutritious green vegetable. A study was conducted to determine the effect of biweekly shoot tip harvests on the growth and yield of Georgia Jet sweet potato grown in the greenhouse using the nutrient film technique (NFT). The nutrient solution consisted of a modified half Hoagland solution. Biweekly shoot tip harvests, beginning 42 days after planting, provided substantial amounts of vegetable greens and did not affect the fresh and dry foliage weights or the storage root number and fresh and dry storage root weights at final harvest. The rates of anion and cation uptake were not affected by tip harvests. Author

N91-28066*# Tuskegee Inst., AL. Agricultural Experiment Station.

EFFECT OF CHANNEL SIZE ON SWEET POTATO STORAGE ROOT ENLARGEMENT IN THE TUSKEGEE UNIVERSITY HYDROPONIC NUTRIENT FILM SYSTEM **c51**

Carlton E. Morris, Edwin Martinez, C. K. Bonsi, Desmond G. Mortley, Walter A. Hill, Cyriacus R. Ogbuehi, and Phil A. Loretan *In*

Alabama A & M Univ., NASA-HBCU Space Science and Engineering Research Forum Proceedings 1989 p 15-19 Sponsored in part by Department of Agriculture (For primary document see N91-28063 19-99)
(Grant NAG10-24)
Avail: NTIS HC/MF A23 CSCL 06C

The potential of the sweet potato as a food source for future long term manned space missions is being evaluated for NASA's Controlled Ecological Life Support Systems (CELSS) program. Sweet potatoes have been successfully grown in a specially designed Tuskegee University nutrient film technique (TU NFT) system. This hydroponic system yielded storage roots as high as 1790 g/plant fresh weight. In order to determine the effect of channel size on the yield of sweet potatoes, the width and depth of the growing channels were varied in two separate experiments. Widths were studied using the rectangular TU NFT channels with widths of 15 cm (6 in), 30 cm (12 in) and 45 cm (18 in). Channel depths of 5 cm (2 in), 10 cm (4 in), and 15 cm (6 in) were studied using a standard NASA fan shaped Biomass Production Chamber (BPC) channel. A comparison of preliminary results indicated that, except for storage root number, the growth and yield of sweet potatoes were not affected by channel width. Storage root yield was affected by channel depth although storage root number and foliage growth were not. Both experiments are being repeated. Author

N91-28067*# Morgan State Univ., Baltimore, MD. Dept. of Physics.
EXCIMER LASER INTERACTION WITH DENTIN OF THE HUMAN TOOTH **c52**
Ernest C. Hammond, Jr., Ruth L. Gilliam, and George R. Baker (Xavier Univ. of Louisiana, New Orleans.) *In* Alabama A & M Univ., NASA-HBCU Space Science and Engineering Research Forum Proceedings 1989 p 21-25 (For primary document see N91-28063 19-99)
Avail: NTIS HC/MF A23 CSCL 06P

The use an excimer laser produced many unusual conical structures within the dentin of the inner part of the human tooth. By varying the frequency of the laser one can disperse the energy and cause more bleeding in laser surgery, but not destroy the cells associated with the incision. Therefore, the healing process will virtually be without scarring. Whereas, using the infrared laser the blood loss would be less, but the healing process would tend to be longer because cells are being destroyed due to the cauterization effect of the laser. The question is, are these structures produced as an interaction with the laser or are they an intrinsic part of the structure. The effects of the laser interaction upon dentin was studied, and in using electron microscopy the interaction of the excimer laser upon the tooth dentin and other various biological tissue is more clearly understood. Author

N91-28068*# Texas Southern Univ., Houston. Dept. of Home Economics.
INTERNATIONAL FOOD PATTERNS FOR SPACE FOOD **c54**
Selina Ahmed, Amanda Cox, and Pauline V. Cornish *In* Alabama A & M Univ., NASA-HBCU Space Science and Engineering Research Forum Proceedings 1989 p 26-32 (For primary document see N91-28063 19-99)
Avail: NTIS HC/MF A23 CSCL 06H

The purpose of this research was to obtain basic data on ethnic foods by studying dietary patterns and multicultural foods, and to determine nutritional status of multicultural space explorers by evaluating dietary, clinical, biochemical, and socioeconomic factors. The study will plan a significant role in providing nutritional research for space explorers of different ethnic backgrounds. It will provide scientific background information by bringing together cross cultural dietary and nutritional from different ethnic groups. Results will also help the health care personnel including physicians, dietitians, and nutritionists to better understand and assist patients from other cultures illness. Also, the results will provide data which will help in the development of future food plans for long duration flights involving manned exploration to Mars and lunar base colonies. Author

N91-28069*# Alcorn State Univ., Lorman, MS. Dept. of Biological Sciences.
IN VITRO REGENERATION OF BASELLA ALBA L **c51**
Norris Allen Edney, Muhammad A. Rizvi, and Narjis F. Rizvi *In* Alabama A & M Univ., NASA-HBCU Space Science and Engineering Research Forum Proceedings 1989 p 33-39 (For primary document see N91-28063 19-99)
Avail: NTIS HC/MF A23 CSCL 06C

Basella alba L. is a tropical vine used as a vegetable in some Asian and African countries. It has potential as a nontraditional crop for small family farms. A short day plant, it blooms during the fall, provided the temperatures are mild. In the southeastern U.S., the short days of fall are associated with subfreezing temperatures, and plants are killed before blooming. Attempts were made to regenerate the plant using tissue culture techniques. Several trials were conducted with different media, hormones, and explants. It was found that nodal segments on Gamborg medium regenerated shoots. Interaction studies of auxins and cytokinins indicated that its endogeneous auxin content might be high because callus proliferated in almost all treatments and roots initiated even when the medium was not supplemented with an auxin. Author

N91-28070*# Alabama A & M Univ., Normal. Dept. of Biology.
MANIPULATING CYANOBACTERIA: SPIRULINA FOR POTENTIAL CELSS DIET **c51**
Mahasin G. Tadros, Woodrow Smith, Peter Mbuthia, and Beverly Joseph *In* Alabama A & M Univ., NASA-HBCU Space Science and Engineering Research Forum Proceedings 1989 p 40-44 (For primary document see N91-28063 19-99)
(Contract NCC2-501)
Avail: NTIS HC/MF A23 CSCL 06C

Spirulina sp. as a bioregenerative photosynthetic and an edible alga for spacecraft crew in a CELSS, was characterized for the biomass yield in batch cultures, under various environmental conditions. The partitioning of the assimalitory products (proteins, carbohydrates, lipids) were manipulated by varying the environmental growth conditions. Experiments with Spirulina have shown that under stress conditions (i.e., high light 160 uE/sq m/s, temperature 38 C, nitrogen or phosphate limitation; 0.1 M sodium chloride) carbohydrates increased at the expense of proteins. In other experiments, where the growth media were sufficient in nutrients and incubated under optimum growth conditions, the total of the algal could be manipulated by growth conditions. These results support the feasibility of considering Spirulina as a subsystem in CELSS because of the ease with which its nutrient content can be manipulated. Author

N91-28071*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, CA.
SEASONAL NITROUS OXIDE FLUX FROM AN INTENSIVELY MANAGED PASTURE IN A HUMID SUBTROPICAL ECOSYSTEM Abstract Only **c47**
Eugene A. Brams, W. H. Anthony, G. L. Hutchinson (Agricultural Research Service, Fort Collins, CO.), and G. P. Livingston *In* Alabama A & M Univ., NASA-HBCU Space Science and Engineering Research Forum Proceedings 1989 p 45 (For primary document see N91-28063 19-99)
Avail: NTIS HC/MF A23 CSCL 04B

Nitrous oxide (N2O) flux from vented chambers was measured over intensively and minimally managed bermuda grass hay meadows in a humid, subtropical ecosystem for several years during scheduled sampling protocol following harvest, fertilization and rainfall events while measuring diel N2O emissions once during each of 5 seasonal day growth cycles which divided each calendar year. Soil pools of nitrite NO2(-), nitrate NO3(-), and ammonia (NH3) were measured in soil samples taken at 2 and 10 cm depths during each emission collection to determine transformations of the nitrogen pools coupled with N2O emissions. The highest diel N2O emission occur midday in the Spring cycle, measuring 9.0 g N/ha/d only for several weeks, while emissions dropped to less than 1.0 g N/ha/day during hot, dry, and colder months. Intensively managed meadows (4 fertilizations and harvests per year plus pest management) induced higher seasonal

N2O emissions than minimal treatment (1 fertilization and harvest) averaging 2.75 and 5.97 g N/ha/day. Nitrous oxide emission data as responses to soil parameters and environmental parameters were also measured where air temperature, soil moisture, and fertilization were the most powerful factors. Author

N91-28072*# Alabama A & M Univ., Normal. Dept. of Biology.
X RAY SENSITIVITY OF DIPLOID SKIN FIBROBLASTS FROM PATIENTS WITH FANCONI'S ANEMIA Abstract Only **c52**
Ranjini Kale *In* Alabama A & M Univ., NASA-HBCU Space Science and Engineering Research Forum Proceedings 1989 p 46 (For primary document see N91-28063 19-99)
Avail: NTIS HC/MF A23 CSCL 06P

Experiments were performed on Fanconi's anemia and normal human fibroblast cell lines growing in culture in an attempt to correlate cell cycle kinetics with genomic damage and determine their bearing on the mechanism of chromosome aberration induction. FA fibroblasts showed a significantly increased susceptibility to chromosomal breakage by x rays in the G2 phase of the cell cycle. No such response was observed in fibroblasts irradiated in the G0 phase. The observed increases in achromatic lesions and in chromatid deletions in FA cells as compared with normal cells appear to indicate that FA cells are deficient in strand break repair and also possibly in base damage excision repair. Experiments are now in progress to further elucidate the mechanisms involved. Author

N91-28073*# Clark-Atlanta Univ., GA. Dept. of Mathematics.
CONSTRUCTION OF STABLE EXPLICIT FINITE-DIFFERENCE SCHEMES FOR SCHROEDINGER TYPE DIFFERENTIAL EQUATIONS **c64**
Ronald E. Mickens *In* Alabama A & M Univ., NASA-HBCU Space Science and Engineering Research Forum Proceedings 1989 p 47-52 (For primary document see N91-28063 19-99)
Avail: NTIS HC/MF A23 CSCL 12A

A family of conditionally stable, forward Euler finite difference equations can be constructed for the simplest equation of Schroedinger type, namely u sub t - iu sub xx. Generalization of this result to physically realistic Schroedinger type equations is presented. Author

N91-28074*# Jackson State Univ., MS. Dept. of Computer Science.
IMAGE DATABASES: PROBLEMS AND PERSPECTIVES **c82**
V. Naidu Gudivada *In* Alabama A & M Univ., NASA-HBCU Space Science and Engineering Research Forum Proceedings 1989 p 53-60 (For primary document see N91-28063 19-99)
(Contract DE-FG05-86ER-75274)
Avail: NTIS HC/MF A23 CSCL 05B

With the increasing number of computer graphics, image processing, and pattern recognition applications, economical storage, efficient representation and manipulation, and powerful and flexible query languages for retrieval of image data are of paramount importance. These and related issues pertinent to image data bases are examined. Author

N91-28075*# Spelman Coll., Atlanta, GA. Dept. of Mathematics.
IMPLEMENTATION OF AN ALGORITHM FOR CYLINDRICAL OBJECT IDENTIFICATION USING RANGE DATA **c61**
Sylvia T. Bozeman and Benjamin J. Martin *In* Alabama A & M Univ., NASA-HBCU Space Science and Engineering Research Forum Proceedings 1989 p 61-68 (For primary document see N91-28063 19-99)
Avail: NTIS HC/MF A23 CSCL 09B

One of the problems in 3-D object identification and localization is addressed. In robotic and navigation applications the vision system must be able to distinguish cylindrical or spherical objects as well as those of other geometric shapes. An algorithm was developed to identify cylindrical objects in an image when range data is used. The algorithm incorporates the Hough transform for line detection using edge points which emerge from a Sobel mask. Slices of the data are examined to locate arcs of circles using the normal equations of an over-determined linear system. Current efforts are devoted to testing the computer implementation of the algorithm. Refinements are expected to continue in order to accommodate cylinders in various positions. A technique is sought which is robust in the presence of noise and partial occlusions. Author

N91-28076*# Morgan State Univ., Baltimore, MD. Dept. of Physics.
MATHEMATICAL MODELS FOR FILM SENSITIVITY MEASUREMENTS **c35**
Ernest C. Hammond, Jr. and Gerald R. Baker *In* Alabama A & M Univ., NASA-HBCU Space Science and Engineering Research Forum Proceedings 1989 p 69-76 (For primary document see N91-28063 19-99)
Avail: NTIS HC/MF A23 CSCL 14E

The quality of the pictorial record developed from photographic material depends on the composition of the material, the procedures used in its exposure and processing, as well as, the nature of the physical and temporal environment extant during the creation of the record. By holding many of the variables fixed, the effect of the two environmental parameters, namely temperature and aging are examined on the characteristic curve of a given film. Polynomial and exponential functions are evaluated as empirical formulas for the characteristic curve, and the sensitivity of derived coefficients to the selected parameters is assessed. Author

N91-28077*# Florida Agricultural and Mechanical Univ., Tallahassee. Dept. of Physics.
THE PREDICTION OF PSEUDO-RESONANCE POSITIONS IN THE SCHWINGER VARIATIONAL PRINCIPLE **c72**
Charles A. Weatherford, Roy Tucker, and Gregory Odom *In* Alabama A & M Univ., NASA-HBCU Space Science and Engineering Research Forum Proceedings 1989 p 77-83 (For primary document see N91-28063 19-99)
(Contract NCC2-492)
Avail: NTIS HC/MF A23 CSCL 20H

The Schwinger Variational Principle is appled to s-wave electron-hydrogen atom scattering. It is shown computationally, that, consistent with a paper by B. Apagyi, P. Levay, and K. Ladanyi, there are pseudo-resonances at the static exchange level of approximation, but not at the static level. The T-matrix was employed, as well as, the K-matrix version of the Schwinger Principle, with a real Slater basis, and obtained the same results in both. The origin of the pseudo-resonances as resulting from singularities in the separable potential that is effectively employed in the Lippmann-Schwinger equation from which the Schwinger Variational Principle can be derived. The determination of the pseudo-resonance parameters from the separable potential is computationally inexpensive and may be used to predict the pseudo-resonance parameters for the scattering calculations so that they may be avoided. Author

N91-28078*# Alabama A & M Univ., Huntsville. Dept. of Physics.
GROWTH AND CHARACTERIZATION OF CRYSTALS FOR IR DETECTORS AND SECOND HARMONIC GERERATION DEVICES **c76**
Ravi B. Lal, Ashok K. Batra, Sistla M. Rao, S. S. Bhatia, Kunar P. Chunduru, Ron Paulson, and Tripty K. Moorkherji (Teledyne Brown Engineering, Huntsville, AL.) *In its* NASA-HBCU Space Science and Engineering Research Forum Proceedings 1989 p 84-89 Sponsored in part by Clarkson Univ. (For primary document see N91-28063 19-99)
Avail: NTIS HC/MF A23 CSCL 20L

Two types of materials, L-arginine phosphate (LAP) and doped triglycine sulfate (TGS), are examined for their growth characteristics and relevant properties for second harmonic generation and IR detector applications, respectively. Author

N91-28079*# Jackson State Univ., MS.
JACKSON STATE UNIVERSITY'S CENTER FOR SPATIAL DATA RESEARCH AND APPLICATIONS: NEW FACILITIES AND NEW PARADIGMS **c14**
Bruce E. Davis and Gregory Elliot *In* Alabama A & M Univ., NASA-HBCU Space Science and Engineering Research Forum Proceedings 1989 p 90-95 (For primary document see N91-28063 19-99)
Avail: NTIS HC/MF A23 CSCL 14B

Jackson State University recently established the Center for Spatial Data Research and Applications, a Geographical Information System (GIS) and remote sensing laboratory. Taking advantage of new technologies and new directions in the spatial (geographic) sciences, JSU is building a Center of Excellence in Spatial Data Management. New opportunities for research, applications, and employment are emerging. GIS requires fundamental shifts and new demands in traditional computer science and geographic training. The Center is not merely another computer lab but is one setting the pace in a new applied frontier. GIS and its associated technologies are discussed. The Center's facilities are described. An ARC/INFO GIS runs on a Vax mainframe, with numerous workstations. Image processing packages include ELAS, LIPS, VICAR, and ERDAS. A host of hardware and software peripheral are used in support. Numerous projects are underway, such as the construction of a Gulf of Mexico environmental data base, development of AI in image processing, a land use dynamics study of metropolitan Jackson, and others. A new academic interdisciplinary program in Spatial Data Management is under development, combining courses in Geography and Computer Science. The broad range of JSU's GIS and remote sensing activities is addressed. The impacts on changing paradigms in the university and in the professional world conclude the discussion. Author

N91-28080*# Alabama A & M Univ., Huntsville. Dept. of Physics.
SOLUTION GROWTH OF TRIGLYCINE SULFATE (TGS) CRYSTALS ON THE INTERNATIONAL MICROGRAVITY LABORATORY (IML-1) **c76**
Ravi B. Lal, Ashok K. Batra, Li Yang, W. R. Wilcox, and J. D. Trolinger (MetroLaser, Irvine, CA.) *In its* NASA-HBCU Space Science and Engineering Research Forum Proceedings 1989 p 96-100 (For primary document see N91-28063 19-99)
(Contract NAS8-36634)
Avail: NTIS HC/MF A23 CSCL 20L

An experiment was planned for the International Microgravity Laboratory (IML-1) to be launched around Feb. 1991. Crystals of triglycine sulfate (TGS) will be grown by low temperature solution crystal growth technique using a multiuser facility called Fluid Experiment System (FES). A special cooled sting technique of solution crystal growth will be used where heat is extracted from the seed crystal through a semi-insulating sting, thereby creating the desired supersaturation near the growing crystal. Also, a holocamera will be used to provide tomography of the three dimensional flow field and particle image displacement velocimetry to monitor the convective flows. Author

N91-28081*# National Aeronautics and Space Administration. Earth Resources Lab., Bay Saint Louis, MS.
A STUDY OF SPATIAL DATA MANAGEMENT AND ANALYSIS SYSTEMS **c82**
Clyde Christopher (Jackson State Univ., MS.) and Richard Galle *In* Alabama A & M Univ., NASA-HBCU Space Science and Engineering Research Forum Proceedings 1989 p 101-10 (For primary document see N91-28063 19-99)
Avail: NTIS HC/MF A23 CSCL 05B

The Earth Resources Laboratory of the NASA Stennis Space Center is a center of space related technology for Earth observations. It has assumed the task, in a joint effort with Jackson State University, to reach out to the science community and acquire information pertaining to characteristics of spatially oriented data processing. Author

N91-28082*# Alabama A & M Univ., Huntsville. Dept. of Chemistry.
ANALYSIS OF CURED CARBON-PHENOLIC DECOMPOSITION PRODUCTS TO INVESTIGATE THE THERMAL DECOMPOSITION OF NOZZLE MATERIALS **c24**
James M. Thompson and Janice D. Daniel *In its* NASA-HBCU Space Science and Engineering Research Forum Proceedings 1989 p 108-126 (For primary document see N91-28063 19-99)
Avail: NTIS HC/MF A23 CSCL 11D

The development of a mass spectrometer/thermal analyzer/computer (MS/TA/Computer) system capable of providing simultaneous thermogravimetry (TG), differential thermal analysis (DTA), derivative thermogravimetry (DTG) and evolved gas detection and analysis (EGD and EGA) under both atmospheric and high pressure conditions is described. The combined system was used to study the thermal decomposition of the nozzle material that constitutes the throat of the solid rocket boosters (SRB). Author

N91-28083*# Miles Coll., Birmingham, AL.
THE 3-(BROMOACETAMIDO)-PROPYLAMINE HYDROCHLORIDE: A NOVEL SULFHYDRYL REAGENT AND ITS FUTURE POTENTIAL IN THE CONFIGURATIONAL STUDY OF S1-MYOSIN **c52**
Prasanta Sharma and Herbert C. Cheung (Alabama Univ., Birmingham.) *In* Alabama A & M Univ., NASA-HBCU Space Science and Engineering Research Forum Proceedings 1989 p 127-13 (For primary document see N91-28063 19-99)
(Grant NIH-AR-31239)
Avail: NTIS HC/MF A23 CSCL 06P

Configurational study of S1-Myosin is an important step towards understanding force generation in muscle contraction. Previously reported NMR studies were corroborated. A new compound was synthesized, 3-(Bromoacetamido)-propylamine hydrochloride. Its potential as a sulfhydryl reagent provides an indirect but elegant approach towards future structural elucidation of S1-Myosin. The preliminary investigation has shown that this compound, BAAP, reacted with S1 in the absence of MgADP. The modified enzyme had a 2-fold increase in CaATPase activity and no detectable K-EDTA ATPase activity. Reaction of BAAP with S1 in the presence of MgADP resulted in a modified enzyme which retained a Ca-ATPase activity that was about 60 percent of the unmodified S1 and had essentially zero K-EDTA ATPase activity. Sulfhydryl titration indicated that about 1.5 and 3.5 SH groups per S1 molecule were blocked by BAAP in the absence and presence of MgADP, respectively. When coupled to a carboxyl group of EDTA, the resulting reagent could become a useful SH reagent in which chelated paramagnetic or luminescent lanthanide ions can be exploited to probe S1 conformation. Author

N91-28084*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, AL.
ELLIPSOMETRIC MEASUREMENT OF LIQUID FILM THICKNESS **c34**
Ki Joon Chang and D. O. Frazier *In* Alabama A & M Univ., NASA-HBCU Space Science and Engineering Research Forum Proceedings 1989 p 134-14 (For primary document see N91-28063 19-99)
Avail: NTIS HC/MF A23 CSCL 20D

The immediate objective of this research is to measure liquid film thickness from the two equilibrium phases of a monotectic system in order to estimate the film pressure of each phase. Thus liquid film thicknesses on the inside walls of the prism cell above the liquid level have been measured ellipsometrically for the monotectic system of succinonitrile and water. The thickness varies with temperature and composition of each plane. The preliminary results from both layers at 60 deg angle of incidence show nearly uniform thickness from about 21 to 23 C. The thickness increases with temperature but near 30 C the film appears foggy and scatters the laser beam. As the temperature of the cell is raised beyond room temperature it becomes increasingly difficult to equalize the temperature inside and outside the cell. The fogging

may also be an indication that solution, not pure water, is adsorbed onto the substrate. Nevertheless, preliminary results suggest that ellipsometric measurement is feasible and necessary to measure more accurately and rapidly the film thickness and to improve thermal control of the prism walls. Author

N91-28085*# Texas Southern Univ., Houston. Dept. of Chemistry.
THE FORMATION AND STUDY OF TITANIUM, ZIRCONIUM, AND HAFNIUM COMPLEXES **c25**
Bobby Wilson, Sam Sarin, Laverne Smith, and Melanie Wilson *In* Alabama A & M Univ., NASA-HBCU Space Science and Engineering Research Forum Proceedings 1989 p 141-14 (For primary document see N91-28063 19-99)
Avail: NTIS HC/MF A23 CSCL 07D

Research involves the preparation and characterization of a series of Ti, Zr, Hf, TiO, and HfO complexes using the poly(pyrazole) borates as ligands. The study will provide increased understanding of the decomposition of these coordination compounds which may lead to the production of molecular oxygen on the Moon from lunar materials such as ilmenite and rutile. The model compounds are investigated under reducing conditions of molecular hydrogen by use of a high temperature/pressure stainless steel autoclave reactor and by thermogravimetric analysis. Author

N91-28086*# Hampton Univ., VA. Dept. of Physics.
KAON-NUCLEUS SCATTERING **c72**
Byungsik Hong, Warren W. Buck, and Khin M. Maung *In* Alabama A & M Univ., NASA-HBCU Space Science and Engineering Research Forum Proceedings 1989 p 146-16 (For primary document see N91-28063 19-99)
Avail: NTIS HC/MF A23 CSCL 20H

Two kinds of number density distributions of the nucleus, harmonic well and Woods-Saxon models, are used with the t-matrix that is taken from the scattering experiments to find a simple optical potential. The parameterized two body inputs, which are kaon-nucleon total cross sections, elastic slope parameters, and the ratio of the real to imaginary part of the forward elastic scattering amplitude, are shown. The eikonal approximation was chosen as the solution method to estimate the total and absorptive cross sections for the kaon-nucleus scattering. Author

N91-28087*# Alabama A & M Univ., Normal. Dept. of Physics.
PHASE CONJUGATION BY DEGENERATE FOUR WAVE MIXING IN DISODIUM FLUORESCEIN SOLUTION IN METHANOL **c25**
Hossin Abdeldayem, P. Chandra Sekhar, P. Venkateswarlu, and M. C. Geroge *In* Alabama A & M Univ., NASA-HBCU Space Science and Engineering Research Forum Proceedings 1989 p 162-17 (For primary document see N91-28063 19-99)
Avail: NTIS HC/MF A23 CSCL 07D

Organic dyes are known to show the resonant type of nonlinear optical properties, including phase conjugation. In the present work, disodium fluorescein in methanol is used as an organic nonlinear medium for degenerate four wave mixing at 532 nm to see the intensity dependence of the phase conjugate signal at different concentrations of the solution. It is observed that the maximum reflectivity of the signal occurs in a concentration range of 5 x 10(exp -3)/cu cm to 1.2 x 10(exp -2) g/cu cm. It is also observed that the intensity of the signal drops suddenly to less than half of its maximum outside the concentration range mentioned above. An investigation of the phase conjugate signal intensity by changing the delay time between probe signal and the forward pump is also examined. Briefly discussed is the possibility of population grating in dye liquids as a source of enhancing the third order susceptibility besides the other techniques mentioned in reference. The experiment is done by beam splitting the second harmonic (532 nm) of Nd:YAG laser, Q-switched at 20 pulses/sec (pulse width is approximately 8 and 200 mJ per pulse). Author

N91-28088*# Texas Southern Univ., Houston. Dept. of Chemistry.
POLAROGRAPHIC STUDY OF CADMIUM 5-HYDROXY 2-(HYDROXYMETHYL) 4H-PYRAN-4-ONE COMPLEX **c25**
Ray F. Wilson and Robert C. Daniels *In* Alabama A & M Univ., NASA-HBCU Space Science and Engineering Research Forum Proceedings 1989 p 171-18 Sponsored in part by DOE (For primary document see N91-28063 19-99)
Avail: NTIS HC/MF A23 CSCL 07D

A polarographic study was performed on the products formed in the interaction of cadmium (II) with a 5-hydroxy 2-(hydroxymethyl) 4H-Pyran-4-one, using varying conditions of pH, supporting electrolytes, and concentrations. Measurements using the differential pulse method show that cadmium (II) exhibits a molar combining ratio of complexing agents to cation ranging from 1 to 1 to 3 to 1 depending on the pH and the supporting electrolyte employed. Author

N91-28089*# Fisk Univ., Nashville, TN. Dept. of Physics.
PURIFICATION, GROWTH, AND CHARACTERIZATION OF Zn(x)Cd(1-x)Se CRYSTALS **c76**
E. Silberman, A. Burger, W. Chen, D. O. Henderson, S. H. Morgan, John M. Springer, and Y. Yao *In* Alabama A & M Univ., NASA-HBCU Space Science and Engineering Research Forum Proceedings 1989 p 188-19 (For primary document see N91-28063 19-99)
(Grant NAG8-113)
Avail: NTIS HC/MF A23 CSCL 20L

The purification of starting materials which were used in the growth of Zn(x)Cd(1-x)Se (x = 0.2) single crystals using the traveling solution method (TSM) is reported. Up to 13 cm long single crystals and as grown resistivities of 6 x 10(exp 12) ohm/cm could be achieved. Infrared and Raman spectra of Zn(0.2)Cd(0.8)Se are also presented and discussed. Author

N91-28090*# Morgan State Univ., Baltimore, MD. Dept. of Physics.
A SCANNING ELECTRON MICROSCOPY STUDY OF THE MACRO-CRYSTALLINE STRUCTURE OF 2-(2,4-DINITROBENZYL) PYRIDINE **c76**
Jacqueline Ware and Ernest C. Hammond, Jr. *In* Alabama A & M Univ., NASA-HBCU Space Science and Engineering Research Forum Proceedings 1989 p 195-20 (For primary document see N91-28063 19-99)
Avail: NTIS HC/MF A23 CSCL 20L

The compound, 2-(2,4-dinitrobenzyl) pyridine, was synthesized in the laboratory; an introductory level electron microscopy study of the macro-crystalline structure was conducted using the scanning electron microscope (SEM). The structure of these crystals was compared with the macrostructure of the crystal of 2-(2,4-dinitrobenzyl) pyridinium bromide, the hydrobromic salt of the compound which was also synthesized in the laboratory. A scanning electron microscopy crystal study was combined with a study of the principle of the electron microscope. Author

N91-28091*# Howard Univ., Washington, DC. Dept. of Physics and Astronomy.
STRUCTURES OF CYANO-BIPHENYL LIQUID CRYSTALS **c76**
Yuan-Chao Chu, Tung Tsang, E. Rahimzadeh, and L. Yin *In* Alabama A & M Univ., NASA-HBCU Space Science and Engineering Research Forum Proceedings 1989 p 205-21 (For primary document see N91-28063 19-99)
(Grant NAG5-156)
Avail: NTIS HC/MF A23 CSCL 20L

The structures of p-alkyl- p'-cyano- bicyclohexanes, C(n)H(2n+1) (C6H10)(C6H10) CN (n-CCH), and p-alkyl- p'-cyano-biphenyls, C(n)H(2n+1) (C6H4)(C6H4) CN (n-CBP), were studied. It is convenient to use an x ray image intensification device to search for symmetric x ray diffraction patterns. Despite the similarities in molecular structures of these compounds, very different crystal structures were found. For the smectic phase of 2CCH, the structure is close to rhombohedral with threefold symmetry. In contrast, the structure is close to hexagonal

close-packed with two molecules per unit cell for 4CCH. Since intermolecular forces may be quite weak for these liquid crystals systems, it appears that crystal structures change considerably when the alkyl chain length is slightly altered. Different structures were also found in the crystalline phase of n-CBP for n = 6 to 9. For n = 7 to 9, the structures are close to monclinic. The structures are reminiscent of the smectic-A liquid crystal structures with the linear molecules slightly tilted away from the c-axis. In contrast, the structure is quite different for n = 6 with the molecules nearly perpendicular to the c-axis. Author

N91-28092*# Virginia State Univ., Petersburg. Dept. of Physics.
STUDIES OF SUPERCONDUCTING MATERIALS WITH MUON SPIN ROTATION **c76**
Michael R. Davis, Carey E. Stronach, W. J. Kossler, H. E. Schone, X. H. Yu, Y. J. Uemúra, B. J. Sternlieb, J. R. Kempton, J. Oostens, and W. F. Lankford (George Mason Univ., Fairfax, VA.) *In* Alabama A & M Univ., NASA-HBCU Space Science and Engineering Research Forum Proceedings 1989 p 211-21 Sponsored in part by DOE and Natural Sciences and Engineering Research Council (For primary document see N91-28063 19-99)
(Grants NAG1-416; NSF DMR-85-03223)
Avail: NTIS HC/MF A23 CSCL 20L

The muon spin rotation/relaxation technique was found to be an exceptionally effective means of measuring the magnetic properties of superconductors, including the new high temperature superconductor materials, at the microscopic level. The technique directly measures the magnetic penetration depth (type II superconductors (SC's)) and detects the presence of magnetic ordering (antiferromagnetism or spin-glass ordering were observed in some high temperature superconductor (HTSC's) and in many closely related compounds). Extensive studies of HTSC materials were conducted by the Virginia State University - College of William and Mary - Columbia University collaboration at Brookhaven National Laboratory and TRIUMF (Vancouver). A survey of LaSrCuO and YBaCaCuO systems shows an essentially linear relationship between the transition temperature T(sub c) and the relaxation rate. This appears to be a manifestation of the proportionality between T(sub c) and the Fermi energy, which suggests a high energy scale for the SC coupling, and which is not consistent with the weak coupling of phonon-mediated SC. Studies of LaCuO and YBaCuO parent compounds show clear evidence of antiferromagnetism. YBa2Cu(3-x)CO(x)O7 shows the simultaneous presence of spin-glass magnetic ordering and superconductivity. Three-dimensional SC, (Ba, K) BiO3, unlike the layered CuO-based compounds, shows no suggestion of magnetic ordering. Experimental techniques and theoretical implications are discussed. Author

N91-28093*# Hampton Univ., VA. Dept. of Physics.
A 10-WATT CW PHOTODISSOCIATION LASER WITH IODO PERFLUORO-TERT-BUTANE **c36**
Bagher Tabibi and Demetrius D. Venable *In* Alabama A & M Univ., NASA-HBCU Space Science and Engineering Research Forum Proceedings 1989 p 218-23 (For primary document see N91-28063 19-99)
Avail: NTIS HC/MF A23 CSCL 20E

NASA has been investigating the feasibility of direct solar-pumped laser systems for power beaming in space. Among the various gas, liquid, and solid laser systems being proposed as candidates for solar-pumped lasers, the iodine photodissociation gas laser has demonstrated its potential for space application. Of immediate attention is the determination of system requirements and the choice of lasants to improve the system efficiency. The development of an efficient iodine laser depends on the availability of a suitable iodide which has favorable laser kinetics, chemically reversibility, and solar energy utilization. Among the various alkyliodide lasants comparatively tested in a long-pulse system, perfluoro- tert-butyl iodide, T-C4F9I, was found to be the best. However, the operating conditions for the laser medium in a continuously pumped and continuous-flow iodine laser differ considerably from those in the pulsed regime. The results of the continuous wave (CW)) laser performance from t-C4F9I are reported. Perfluoro- n-propyl iodide, n-C3F7I is used for comparison because of its universal use in photodissociation iodine lasers. Author

N91-28094*# Howard Univ., Washington, DC. Dept. of Chemistry.
THE UV PHOTOCHEMISTRY OF C2N2 **c72**
Joshua B. Halpern and Samuel A. Barts *In* Alabama A & M Univ., NASA-HBCU Space Science and Engineering Research Forum Proceedings 1989 p 231-23 Sponsored in part by Danforth Foundation Fellowship (For primary document see N91-28063 19-99)
(Grant NAG5-071)
Avail: NTIS HC/MF A23 CSCL 20H

The absorption, emission, and photodissociation yield spectra of C2N2 were measured in the 220 and 210 nm region near the 4(0)1 and 1(0)1 4(0)1 bands of the A 1 sigma + from the X 1 sigma + system. The emission spectrum showed very few lines which appeared in the absorption spectrum. Moreover, the emission had 660 ns lifetime and, at 210 nm a very large electronic emission quenching rate. Laser induced fluorescence was used to measure the relative yield of CN radicals as a function of photolysis wavelength. This spectrum seemed to follow the absorption spectrum below the dissociation threshold. Energy in the CN fragments appeared to be statistically distributed. Author

N91-28095*# Brandeis Univ., Waltham, MA. Dept. of Computer Science.
ENCOURAGING THE PURSUIT OF ADVANCED DEGREES IN SCIENCE AND ENGINEERING: TOP-DOWN AND BOTTOM-UP METHODOLOGIES **c80**
Anthony B. Maddox, Renee P. Smith-Maddox, and Benson E. Penick (Penick, Benson and Associates, Washington, DC) *In* Alabama A & M Univ., NASA-HBCU Space Science and Engineering Research Forum Proceedings 1989 p 240-24 (For primary document see N91-28063 19-99)
(Grant NGT-22-005-900)
Avail: NTIS HC/MF A23 CSCL 05I

The MassPEP/NASA Graduate Research Development Program (GRDP) whose objective is to encourage Black Americans, Mexican Americans, American Indians, Puerto Ricans, and Pacific Islanders to pursue graduate degrees in science and engineering is described. The GRDP employs a top-down or goal driven methodology through five modules which focus on research, graduate school climate, technical writing, standardized examinations, and electronic networking. These modules are designed to develop and reinforce some of the skills necessary to seriously consider the goal of completing a graduate education. The GRDP is a community-based program which seeks to recruit twenty participants from a pool of Boston-area undergraduates enrolled in engineering and science curriculums and recent graduates with engineering and science degrees. The program emphasizes that with sufficient information, its participants can overcome most of the barriers perceived as preventing them from obtaining graduate science and engineering degrees. Experience has shown that the top-down modules may be complemented by a more bottom-up or event-driven methodology. This approach considers events in the academic and professional experiences of participants in order to develop the personal and leadership skills necessary for graduate school and similar endeavors. Author

N91-28096*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
JPL INITIATIVE ON HISTORICALLY BLACK COLLEGES AND UNIVERSITIES **c80**
Lew Allen, Paul Forte, Jr., and Martin H. Leipold *In* Alabama A & M Univ., NASA-HBCU Space Science and Engineering Research Forum Proceedings 1989 p 247-25 (For primary document see N91-28063 19-99)
Avail: NTIS HC/MF A23 CSCL 05I

Executive order number 12320 of September 15, 1981,

established a program designed to significantly increase the participation of historically black colleges and universities (HBCU's) in Federal programs. Because of its geographical remoteness and position as a contractor operated center, JPL had not participated in grant and training programs with the HBCU's. In recognition of JPL's responsibility to the national commitment on behalf of the historically black colleges and universities, an initiative with effective, achievable guidelines and early progress for a better and more productive interaction between JPL and the HBCU's is described. Numerous areas of interaction with the historically black colleges and universities have been identified and are being inplemented. They have two broad objectives: research interactions and faculty/student interactions. Plans and progress to date for each specific area are summarized. Author

N91-28097*# Lincoln Univ., PA. Dept. of Physics.
LINCOLN ADVANCED SCIENCE AND ENGINEERING REINFORCEMENT (LASER) PROGRAM **c36**
Willie E. Williams *In* Alabama A & M Univ., NASA-HBCU Space Science and Engineering Research Forum Proceedings 1989 p 254-26 Sponsored in part by Department of Education (For primary document see N91-28063 19-99)
(Contract NGT-90020; N00014-83-G-0082)
Avail: NTIS HC/MF A23 CSCL 20E

Lincoln University, under the Lincoln Advanced Science and Engineering Reinforcement (LASER) Program, has identified and successfully recruited over 100 students for majors in technical fields. To date, over 70 percent of these students have completed or will complete technical degrees in engineering, physics, chemistry, and computer science. Of those completing the undergraduate degree, over 40 percent have gone on to graduate and professional schools. This success is attributable to well planned approaches to student recruitment, training, personal motivation, retention, and program staff. Very closely coupled to the above factors is a focus designed to achieve excellence in program services and student performance. Future contributions by the LASER Program to the pool of technical minority graduates will have a significant impact. This is already evident from the success of the students that began the first year of the program. With program plans to refine many of the already successful techniques, follow-on activities are expected to make even greater contributions to the availability of technically trained minorities. For example, undergraduate research exposure, broadened summer, and co-op work experiences will be enhanced. Author

N91-28098*# Gallaudet Coll., Washington, DC.
A MODEL SUMMER PROGRAM FOR HANDICAPPED COLLEGE STUDENTS **c80**
Anne B. Nissen *In* Alabama A & M Univ., NASA-HBCU Space Science and Engineering Research Forum Proceedings 1989 p 262-26 (For primary document see N91-28063 19-99)
Avail: NTIS HC/MF A23 CSCL 05I

During the summer of 1988, the Goddard Space Flight Center was the site of a new NASA project called A Model Summer Program for Handicapped College Students that was directed by Gallaudet University. The project's aim was to identify eight severely physically disabled college students (four from Gallaudet University and four from local historically black colleges and universities (HBCU's)) majoring in technical fields and to assign them technical projects related to aerospace which they would complete under the guidance of mentors who were full time employees of Goddard. A description of the program is presented. Author

N91-28099*# District of Columbia Univ., Washington, DC. Science and Engineering Center.
A SUCCESSFUL INTERVENTION PROGRAM FOR HIGH ABILITY MINORITY STUDENTS **c80**
Winson R. Coleman *In* Alabama A & M Univ., NASA-HBCU Space Science and Engineering Research Forum Proceedings 1989 p 266-26 (For primary document see N91-28063 19-99)
Avail: NTIS HC/MF A23 CSCL 05I

Among professional occupations in the United States, non-Asian minorities are least represented in science and engineering fields. The Bureau of Labor Statistics predicts that over the next decade, civilian employment of scientists and engineers has the potential to grow by 40 percent. Furthermore, projections for the year 2000 indicate that 100,000 fewer B.S. and B.A. degrees will be awarded than were awarded in 1984. The latter projection takes into consideration the overall declining proportion of all 18 year old college students. Within this shrinking pool of 18 year old potential college students will be an increasing proportion of Blacks and Hispanics. In order to change the educational patterns for minority youth, an intense look at the factors that affect the science and mathematics performance of minorities. Furthermore, the work of programs that are successful at producing minority scientists and engineers must be examined and documented with the intent of replicating these programs. The fundamental concern at this time appears to be the quality of precollege experience because research has shown that lack of precollege preparation is the single most important cause of underrepresentation of minorities in science and engineering careers. For many years, intervention programs have attempted to improve the quality of the minority precollege experience by latter year intervention in grades eleven and twelve. Later efforts, such as this one, have concentrated on earlier years. The effectiveness of intervention programs is widely accepted but not rigorously documented. The mechanisms these programs have developed need to be identified and their potential for broader use evaluated. The ultimate goal of such studies would be to provide the different educational communities with a set of proven cost-effective state of the art mechanisms designed to increase participation and success of minority students in science and mathematics-related courses. One such intervention program is the Saturday Academy program for high ability minority students in the Washington, D.C. area. A description of the Saturday Academy is provided with the intent of making it available to personnel who are considering the development of similar projects. The effect of participation in the program on high school graduate rates, college enrollment, and choice of quantitative major is examined. Author

N91-28100*# Spelman Coll., Atlanta, GA.
THE WOMEN IN SCIENCE AND ENGINEERING SCHOLARS PROGRAM **c80**
Etta Z. Falconer and Lori Ann Guy *In* Alabama A & M Univ., NASA-HBCU Space Science and Engineering Research Forum Proceedings 1989 p 270-27 (For primary document see N91-28063 19-99)
Avail: NTIS HC/MF A23 CSCL 05I

The Women in Science and Engineering Scholars Program provides scientifically talented women students, including those from groups underrepresented in the scientific and technical work force, with the opportunity to pursue undergraduate studies in science and engineering in the highly motivating and supportive environment of Spelman College. It also exposes students to research training at NASA Centers during the summer. The program provides an opportunity for students to increase their knowledge of career opportunities at NASA and to strengthen their motivation through exposure to NASA women scientists and engineers as role models. An extensive counseling and academic support component to maximize academic performance supplements the instructional and research components. The program is designed to increase the number of women scientists and engineers with graduate degrees, particularly those with an interest in a career with NASA. Author

N91-28101*# Morgan State Univ., Baltimore, MD. Dept. of Physics.
AN ANALYSIS OF THE MOON'S SURFACE USING REFLECTED ILLUMINATION FROM THE EARTH DURING A WANING CRESCENT LUNAR PHASE **c91**
Ernest C. Hammond, Jr. and Maggie Linton-Petza *In* Alabama A & M Univ., NASA-HBCU Space Science and Engineering Research Forum Proceedings 1989 p 276-28 (For primary document see N91-28063 19-99)
Avail: NTIS HC/MF A23 CSCL 03B

There have been many articles written concerning the lunar after-glow, the spectacular reflection from the moon's surface, and the possible observation of luminescence on the dark side of the moon. The researcher, using a 600 mm cassegrain telescope lense and Kodak 400 ASA T-Max film, photographed the crescent moon whose dark side was clearly visible by the reflected light from earth. The film was digitized to a Perkin-Elmer 1010M microdensitometer for enhancement and enlargement. The resulting pictures indicate a completely different land pattern formation than observed during a full moon. An attempt is made to analyze the observed structures and to compare them to the pictures observed during the normal full moon. There are boundaries on the digitized dark section of the moon that can be identified with structures seen during the normal full moon. But, these variations do change considerably under enhancement.
Author

N91-28102*# Morgan State Univ., Baltimore, MD. Dept. of Physics.
A DENSITOMETRIC ANALYSIS OF IIaO FILM FLOWN ABOARD THE SPACE SHUTTLE TRANSPORTATION SYSTEM STS #3, 7, AND 8 **c35**
Ernest C. Hammond, Jr. *In* Alabama A & M Univ., NASA-HBCU Space Science and Engineering Research Forum Proceedings 1989 p 283-29 (For primary document see N91-28063 19-99)
Avail: NTIS HC/MF A23 CSCL 14E

Since the United States of America is moving into an age of reusable space vehicles, both electronic and photographic materials will continue to be an integral part of the recording techniques available. Film as a scientifically viable recording technique in astronomy is well documented. There is a real need to expose various types of films to the Shuttle environment. Thus, the main objective was to look at the subtle densitometric changes of canisters of IIaO film that was placed aboard the Space Shuttle 3 (STS-3).
Author

N91-28103*# Morgan State Univ., Baltimore, MD. Dept. of Physics.
MOESSBAUER SPECTROSCOPY AND SCANNING ELECTRON MICROSCOPY OF THE MURCHISON METEORITE **c90**
Christopher L. Brown, Frederick W. Oliver, and Ernest C. Hammond, Jr. *In* Alabama A & M Univ., NASA-HBCU Space Science and Engineering Research Forum Proceedings 1989 p 294-29 (For primary document see N91-28063 19-99)
Avail: NTIS HC/MF A23 CSCL 03B

Meteorites provide a wealth of information about the solar system's formation, since they have similar building blocks as the Earth's crust but have been virtually unaltered since their formation. Some stony meteorites contain minerals and silicate inclusions, called chondrules, in the matrix. Utilizing Moessbauer spectroscopy, we identified minerals in the Murchison meteorite, a carbonaceous chondritic meteorite, by the gamma ray resonance lines observed. Absorption patterns of the spectra were found due to the minerals olivine and phyllosilicate. We used a scanning electron microscope to describe the structure of the chondrules in the Murchison meteorite. The chondrules were found to be deformed due to weathering of the meteorite. Diameters varied in size from 0.2 to 0.5 mm. Further enhancement of the microscopic imagery using a digital image processor was used to describe the physical characteristics of the inclusions.
Author

N91-28104*# Tennessee State Univ., Nashville. Dept. of Mechanical Engineering.
SOLVING THE BM CAMELOPARDALIS PUZZLE **c90**
Mathias Teke, Michael R. Busby, and Douglas S. Hall (Vanderbilt Univ., Nashville, TN.) *In* Alabama A & M Univ., NASA-HBCU Space Science and Engineering Research Forum Proceedings 1989 p 298-30 (For primary document see N91-28063 19-99)
(Grants NAG8-111; NSF AST-84-14594)
Avail: NTIS HC/MF A23 CSCL 03B

BM Camelopardalis (=12 Cam) is a chromospherically active binary star with a relatively large orbital eccentricity. Systems with large eccentricities usually rotate pseudosynchronously. However, BM Cam has been a puzzle since its observed rotation rate is virtually equal to its orbital period indicating synchronization. All available photometry data for BM Cam have been collected and analyzed. Two models of modulated ellipticity effect are proposed, one based on equilibrium tidal deformation of the primary star and the other on a dynamical tidal effect. When the starspot variability is removed from the data, the dynamical tidal model was the better approximation to the real physical situation. The analysis indicates that BM Cam is not rotating pseudosynchronously but rotating in virtual synchronism after all.
Author

N91-28105*# Alabama A & M Univ., Normal. School of Engineering and Technology.
AEROSOL SPECKLE EFFECTS ON ATMOSPHERIC PULSED LIDAR BACKSCATTERED SIGNALS **c32**
S. R. Murty *In* Alabama A & M Univ., NASA-HBCU Space Science and Engineering Research Forum Proceedings 1989 p 304-31 (For primary document see N91-28063 19-99)
(Grant NsG-8037)
Avail: NTIS HC/MF A23 CSCL 20N

Lidar systems using atmospheric aerosols as targets exhibit return signal amplitude and power fluctuations which indicate speckle effects. The effects of refractive turbulence along the path on the aerosol speckle field propagation and on the decorrelation time are studied for coherent pulsed lidar systems.
Author

N91-28106*# Bowie State Univ., MD.
AUTOMATED ASSEMBLY IN SPACE **c12**
Sandanand Srivastava, Suren N. Dwivedi (West Virginia Univ., Morgantown.), Toh Teck Soon, Reddy Bandi, Soumen Banerjee, and Cecilia Hughes *In* Alabama A & M Univ., NASA-HBCU Space Science and Engineering Research Forum Proceedings 1989 p 313-32 (For primary document see N91-28063 19-99)
Avail: NTIS HC/MF A23 CSCL 22A

The installation of robots and their use of assembly in space will create an exciting and promising future for the U.S. Space Program. The concept of assembly in space is very complicated and error prone and it is not possible unless the various parts and modules are suitably designed for automation. Certain guidelines are developed for part designing and for an easy precision assembly. Major design problems associated with automated assembly are considered and solutions to resolve these problems are evaluated in the guidelines format. Methods for gripping and methods for part feeding are developed with regard to the absence of gravity in space. The guidelines for part orientation, adjustments, compliances and various assembly construction are discussed. Design modifications of various fasteners and fastening methods are also investigated.
Author

N91-28107*# Tuskegee Inst., AL. School of Engineering and Architecture.
ELECTRODE EROSION IN LOW POWER ARCJET THRUSTERS **c20**
A. Ghosh and Pradosh K. Ray *In* Alabama A & M Univ., NASA-HBCU Space Science and Engineering Research Forum Proceedings 1989 p 323-32 (For primary document see N91-28063 19-99)
(Grant NAG3-726)
Avail: NTIS HC/MF A23 CSCL 21H

Low power arcjet thrusters (0.5 to 3 kW) are currently being considered for North-South station keeping of geosynchronous communication satellites. The erosion mechanisms of cathodes in these thrusters are not well understood. The experimental set-up to produce a steady state electric arc in a gas flow is described and some preliminary theoretical results on cathode erosion are presented.
Author

N91-28108*# National Aeronautics and Space Administration. Langley Research Center, Hampton, VA.
EVALUATION OF ON-BOARD HYDROGEN STORAGE METHODS FOR HYPERSONIC VEHICLES **c28**
Ates Akyurtlu, J. F. Akyurtlu, A. A. Adeyiga, Samara Perdue

(Hampton Univ., VA.), and G. B. Northam *In* Alabama A & M Univ., NASA-HBCU Space Science and Engineering Research Forum Proceedings 1989 p 329-33 (For primary document see N91-28063 19-99)
Avail: NTIS HC/MF A23 CSCL 21D

Hydrogen is the foremost candidate as a fuel for use in high speed transport. Since any aircraft moving at hypersonic speeds must have a very slender body, means of decreasing the storage volume requirements below that for liquid hydrogen are needed. The total performance of the hypersonic plane needs to be considered for the evaluation of candidate fuel and storage systems. To accomplish this, a simple model for the performance of a hypersonic plane is presented. To allow for the use of different engines and fuels during different phases of flight, the total trajectory is divided into three phases: subsonic-supersonic, hypersonic and rocket propulsion phase. The fuel fraction for the first phase is found be a simple energy balance using an average thrust to drag ratio for this phase. The hypersonic flight phase is investigated in more detail by taking small altitude increments. This approach allowed the use of flight profiles other than the constant dynamic pressure flight. The effect of fuel volume on drag, structural mass and tankage mass was introduced through simplified equations involving the characteristic dimension of the plane. The propellant requirement for the last phase is found by employing the basic rocket equations. The candidate fuel systems such as the cryogenic fuel combinations and solid and liquid endothermic hydrogen generators are first screened thermodynamically with respect to their energy densities and cooling capacities and then evaluated using the above model.
Author

N91-28109*# National Aeronautics and Space Administration. Langley Research Center, Hampton, VA.
END-EFFECTOR-JOINT CONJUGATES FOR ROBOTIC ASSEMBLY OF LARGE TRUSS STRUCTURES IN SPACE: A SECOND GENERATION c54
William V. Brewer *In* Alabama A & M Univ., NASA-HBCU Space Science and Engineering Research Forum Proceedings 1989 p 336-34 Prepared in cooperation with Jacksonville State Univ., AL (For primary document see N91-28063 19-99)
Avail: NTIS HC/MF A23 CSCL 06K

Attachment of strut to node can be accomplished with a variety of mechanisms. All require extensive standoff elements (called scars) added to the nodes. These increase packaging volume for the nodes by as much as 300 percent. First generation designs also tend to be either heavy or expensive due to complex parts. Screws thread mechanisms are discussed simplest and most easily manufactured of alternatives. Torque and rotational motion must be transmitted across the strut to end-effector interface accomplishing the joining process and establishing a specific preload. Four drive mechanisms are considered: worm, helical, bevel, and differential gears. Author

N91-28110*# Prairie View Agricultural and Mechanical Coll., TX. Dept. of Electrical Engineering.
MARS SURFACE BASED FACTORY. PHASE 2, TASK 1C: COMPUTER CONTROL OF A WATER TREATMENT SYSTEM TO SUPPORT A SPACE COLONY ON MARS c54
John Fuller, Warsame Ali, and Danette Willis *In* Alabama A & M Univ., NASA-HBCU Space Science and Engineering Research Forum Proceedings 1989 p 343-34 (For primary document see N91-28063 19-99)
Avail: NTIS HC/MF A23 CSCL 06K

In a continued effort to design a surface based factory on Mars for the production of oxygen and water, a preliminary study was made of the surface and atmospheric composition on Mars and determined the mass densities of the various gases in the Martian atmosphere. Based on the initial studies, oxygen and water were determined to be the two products that could be produced economically under the Martian conditions. Studies were also made on present production techniques to obtain water and oxygen. Analyses were made to evaluate the current methods of production that were adaptable to the Martian conditions. Even though the initial effort was the production of oxygen and water, it was found necessary to produce some diluted gases that can be mixed with the oxygen produced to constitute 'breathable' air. The conceptual design of a breathable air manufacturing system, a means of drilling for underground water, and storage of water for future use were completed. The design objective was the conceptual design of an integrated system for the supply of quality water for biological consumption, farming, residential and industrial use. Author

N91-28111*# Central State Univ., Wilberforce, OH. Dept. of Manufacturing Engineering.
SERVOMOTOR-LINKED ARTICULATED VERSATILE END EFFECTOR (SLAVE2) c37
Abayomi J. Ajayi-Majebi, William A. Grissom, Brian Wingard, and Derrick Walker *In* Alabama A & M Univ., NASA-HBCU Space Science and Engineering Research Forum Proceedings 1989 p 349-35 (For primary document see N91-28063 19-99)
(Contract NAGw-1336; JPL-958292)
Avail: NTIS HC/MF A23 CSCL 13I

A strategy is presented for the design and construction of a large master/slave-controlled, five-finger robotic hand. Each of the five fingers will possess four independent axes each driven by a brushless DC servomotor and, thus, four degrees-of-freedom. It is proposed that commercially available components be utilized as much as possible to fabricate a working laboratory model of the device with an anticipated overall length of approximately three feet (0.9 m). The fingers are to be designed to accommodate proximity, tactile, or force/torque sensors imbedded in their structure. In order to provide for the simultaneous control of the operator wears a specially instrumented glove which produces control signals corresponding to the finger configuration and which is capable of conveying sensor feedback signals to the operator. Two dexterous hand master devices are currently commercially available for this application with both undergoing continuing development. Author

N91-28112*# Virginia State Univ., Petersburg. Dept. of Physics.
COMPUTER SIMULATION OF RADIATION DAMAGE IN GALLIUM ARSENIDE c76
John J. Stith, James C. Davenport, and Randolph L. Copeland *In* Alabama A & M Univ., NASA-HBCU Space Science and Engineering Research Forum Proceedings 1989 p 356-36 (For primary document see N91-28063 19-99)
Avail: NTIS HC/MF A23 CSCL 20L

A version of the binary-collision simulation code MARLOWE was used to study the spatial characteristics of radiation damage in proton and electron irradiated gallium arsenide. Comparisons made with the experimental results proved to be encouraging.
Author

N91-28113*# Prairie View Agricultural and Mechanical Coll., TX. Dept. of Mechanical Engineering.
FORCED CONVECTION AND FLOW BOILING WITH AND WITHOUT ENHANCEMENT DEVICES FOR TOP-SIDE-HEATED HORIZONTAL CHANNELS c34
Ronald D. Boyd, Sr. and Jerry C. Turknett *In* Alabama A & M Univ., NASA-HBCU Space Science and Engineering Research Forum Proceedings 1989 p 363-37 Sponsored in part by NASA. Johnson Space Center (For primary document see N91-28063 19-99)
Avail: NTIS HC/MF A23 CSCL 20D

The effect of enhancement devices on flow boiling heat transfer in coolant channels, which are heated either from the top side or uniformly was studied. Studies are completed of the variations in the local (axial and circumferential) and mean heat transfer coefficients in horizontal, top-heated coolant channels with smooth walls and internal heat transfer enhancement devices. The working fluid is freon-11. The objectives are to: (1) examine the variations in both the mean and local (axial and circumferential) heat transfer coefficients for a circular coolant channel with either smooth walls or with both a twisted tape and spiral finned walls; (2) examine the effect of channel diameter (and the length-to-diameter aspect

ratio) variations for the smooth wall channel; and (3) develop and improved data reduction analysis. The case of the top-heated, horizontal flow channel with smooth wall (1.37 cm inside diameter, and 122 cm heated length) was completed. The data were reduced using a preliminary analysis based on the heated hydraulic diameter. Preliminary examination of the local heat transfer coefficient variations indicated that there are significant axial and circumferential variations. However, it appears that the circumferential variation is more significant than the axial ones. In some cases, the circumferential variations were as much as a factor of ten. The axial variations rarely exceeded a factor of three. Author

N91-28114*# National Aeronautics and Space Administration. Langley Research Center, Hampton, VA.
PROGRESS IN PROTON TRANSPORT CODE DEVELOPMENT: MICROELECTRONIC APPLICATION c72
Duc M. Ngo, Warren W. Buck, Tom N. Fogarty (Hampton Univ., VA.), and J. W. Wilson *In* Alabama A & M Univ., NASA-HBCU Space Science and Engineering Research Forum Proceedings 1989 p 371-38 (For primary document see N91-28063 19-99)
Avail: NTIS HC/MF A23 CSCL 20H

The process of target nucleus fragmentation by energetic protons is examined, and their effects on microelectronic devices are considered. A formalism for target fragment transport is presented. Future applications to microelectronic effects are discussed. Author

N91-28115*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, AL.
A STUDY OF MICROSTRUCTURAL CHARACTERISTICS AND DIFFERENTIAL THERMAL ANALYSIS OF Ni-BASED SUPERALLOYS c26
M. D. Aggarwal, R. B. Lal, Samuel A. Oyekenu (Alabama A & M Univ., Normal.), Richard Parr, and Stephen Gentz *In* Alabama A & M Univ., NASA-HBCU Space Science and Engineering Research Forum Proceedings 1989 p 382-38 (For primary document see N91-28063 19-99)
(Grant NAG8-076)
Avail: NTIS HC/MF A23 CSCL 11F

The objective of this work is to correlate the mechanical properties of the Ni-based superalloy MAR M246(Hf) used in the Space Shuttle Main Engine with its structural characteristics by systematic study of optical photomicrographs and differential thermal analysis. The authors developed a method of predicting the liquidus and solidus temperature of various nickel based superalloys (MAR-M247, Waspaloy, Udimet-41, polycrystalline and single crystals of CMSX-2 and CMSX-3) and comparing the predictions with the experimental differential thermal analysis (DTA) curves using Perkin-Elmer DTA 1700. The method of predicting these temperatures is based on the additive effect of the components dissolved in nickel. The results were compared with the experimental values. Author

N91-28116*# Prairie View Agricultural and Mechanical Coll., TX. Dept. of Mechanical Engineering.
SUBCOOLED FREON-11 FLOW BOILING IN TOP-HEATED FINNED COOLANT CHANNELS WITH AND WITHOUT A TWISTED TAPE c36
Alvin Smith and Ronald D. Boyd, Sr. *In* Alabama A & M Univ., NASA-HBCU Space Science and Engineering Research Forum Proceedings 1989 p 390-39 Sponsored by NASA. Johnson Space Center and Sandia National Labs. (For primary document see N91-28063 19-99)
Avail: NTIS HC/MF A23 CSCL 20E

An experimental study was conducted in top-heated finned horizontal tubes to study the effect of enhancement devices on flow boiling heat transfer in coolant channels. The objectives are to examine the variations in both the mean and local (axial and circumferential) heat transfer coefficients for circular coolant channels with spiral finned walls and/or spiral fins with a twisted tape, and improve the data reduction technique of a previous investigator. The working fluid is freon-11 with an inlet temperature of 22.2 C (approximately 21 C subcooling). The coolant channel's exit pressure and mass velocity are 0.19 M Pa (absolute) and 0.21 Mg/sq. ms, respectively. Two tube configurations were examined; i.e., tubes had either 6.52 (small pitch) or 4.0 (large pitch) fins/cm of the circumferential length (26 and 16 fins, respectively). The large pitch fins were also examined with a twisted tape insert. The inside nominal diameter of the copper channels at the root of the fins was 1.0 cm. The results show that by adding enhancement devices, boiling occurs almost simultaneously at all axial locations. The case of spiral fins with large pitch resulted in larger mean (circumferentially averaged) heat transfer coefficients, h sub m, at all axial locations. Finally, when twisted tape is added to the tube with large-pitched fins, the power required for the onset of boiling is reduced at all axial and circumferential locations. Author

N91-28117*# Hampton Univ., VA. Dept. of Physics.
XeCl LASER PUMPED IODINE LASER USING t-C4F9I c36
In Heon Hwang and Kwang S. Han *In* Alabama A & M Univ., NASA-HBCU Space Science and Engineering Research Forum Proceedings 1989 p 398-40 (For primary document see N91-28063 19-99)
(Grant NAG1-441)
Avail: NTIS HC/MF A23 CSCL 20E

An iodine photodissociation laser using t-C4F9I as the active material was pumped by an XeCl laser. An iodine laser output energy of 3 mJ with pulse duration of 25 ns was obtained when the pumping pulse energy was 80 mJ, the iodide pressure was 70 torr, and the reflectance of the output mirror was 85 percent. The high pumping efficiency and low threshold pump power achieved in this experiment are attributable to the high absorption cross section at the pump laser wavelength (308 nm) of the iodide used. Author

N91-28118*# Howard Univ., Washington, DC. Dept. of Electrical Engineering.
CHARACTERIZATION OF QUANTUM WELL STRUCTURES USING A PHOTOCATHODE ELECTRON MICROSCOPE c76
Michael G. Spencer and Craig J. Scott (Naval Research Lab., Washington, DC.) *In* Alabama A & M Univ., NASA-HBCU Space Science and Engineering Research Forum Proceedings 1989 p 405-40 (For primary document see N91-28063 19-99)
Avail: NTIS HC/MF A23 CSCL 20L

Present day integrated circuits pose a challenge to conventional electronic and mechanical test methods. Feature sizes in the submicron and nanometric regime require radical approaches in order to facilitate electrical contact to circuits and devices being tested. In addition, microwave operating frequencies require careful attention to distributed effects when considering the electrical signal paths within and external to the device under test. An alternative testing approach which combines the best of electrical and optical time domain testing is presented, namely photocathode electron microscope quantitative voltage contrast (PEMQVC). Author

N91-28119*# Morgan State Univ., Baltimore, MD. Dept. of Physics.
A DENSITOMETRIC ANALYSIS OF COMMERCIAL 35mm FILMS c35
Ernest C. Hammond, Jr. and Christopher Ruffin, III *In* Alabama A & M Univ., NASA-HBCU Space Science and Engineering Research Forum Proceedings 1989 p 409-42 (For primary document see N91-28063 19-99)
Avail: NTIS HC/MF A23 CSCL 14E

IIaO films have been subjected to various sensitometric tests. The have included thermal and aging effects and reciprocity failure studies. In order to compare the special IIaO film with popular brands of 35 mm films and their possible use in astrophotography, Agfa, Fuji and Kodak print and slide formats, as well as black and white and color formats, were subjected to sensitometric, as well as densitometric analysis. A scanning electron microscope was used to analyze grain structure size, and shape as a function of both speed and brand. Preliminary analysis of the grain structure using an ISI-SS40 scanning electron microscope indicates that

the grain sizes for darker densities are much larger than the grain size for lighter densities. Researchers analyze the scanning electron microscope findings of the various grains versus densities as well as enhancement of the grains, using the IP-8500 Digital Image Processor. Author

N91-28120*# National Aeronautics and Space Administration. Langley Research Center, Hampton, VA.
DEVELOPMENT OF FLASHLAMP-PUMPED Q-SWITCHED Ho:Tm:Cr:YAG LASERS FOR MID-INFRARED LIDAR APPLICATION **c35**
Young S. Choi, Kyong H. Kim, Donald A. Whitney (Hampton Univ., VA.), Robert V. Hess, Norman P. Barnes, Clayton H. Bair, and Philip Brockman *In* Alabama A & M Univ., NASA-HBCU Space Science and Engineering Research Forum Proceedings 1989 p 422-42 (For primary document see N91-28063 19-99)
(Grant NAG1-877)
Avail: NTIS HC/MF A23 CSCL 14E

A flashlamp-pumped 2.1 micron Ho:Tm:Cr:YAG laser was studied for both normal mode and Q-switched operations under a wide variety of experimental conditions in order to optimize performance. Laser output energy, slope efficiency, threshold and pulselength were determined as a function of operating temperature, output mirror reflectivity, input electrical energy and Q-switch opening time. The measured normal-mode laser thresholds of a Ho(3+) (0.45 atomic percent):Tm(3+) (2.5 atomic percent):Cr(3+) (0.8 atomic percent):YAG crystal ranged form 26 to 50 J between 120 and 200 K with slope efficiencies up to 0.36 percent with a 60 percent reflective output mirror. Under Q-switched operation the slope efficiency was 90 percent of the normal-mode result. Development of solid state lasers with Ho(3+), Tm(3+) and/or Er(3+) doped crystals has been pursued by NASA for eye-dafe mid-infrared LIDAR (light detection and ranging) application. As a part of the project, the authors have been working on evaluating Ho(3+):Tm(3+):Cr(3+):YAG crystals for normal-mode and Q-switched 2.1 micron laser operations in order to determine an optimum Tm(3+) concentration under flashlamp pumping conditions. Lasing properties of the Ho(3+) in the mid-infrared region have been studied by many research groups since the early 1960's. However, the technology of those lasers is still premature for lidar application. In order to overcome the inefficiency related to narrow absorption bands of the Ho(3+), Tm(3+) and Er(3+), the erbium has been replaced by chromium. The improvement in flashlamp-pumped Ho(3+) laser efficiency has been demonstrated recently by several research groups by utilizing the broad absorption spectrum of Cr(3+) which covers the flashlamp's emission spectrum. Efficient energy transfer to the Tm(3+) and then the Ho(3+) occurs subsequently. It is known that high Tm(3+) concentration and low Ho(3+) concentration are preferred to achieve a quantum efficiency approaching two and to avoid large reabsorption losses. However, determination of the optimum Tm(3+) concentration required to ensure efficient energy transfer from Cr(3+) to Tm(3+) and from Tm(3+) to Ho(3+) has not been made in the Ho:Tm:CR:YAG crystal. The results obtained so far are given. Author

N91-28121*# Tuskegee Inst., AL. Materials Research Lab.
EFFECT OF GRINDING ON THE FATIGUE LIFE OF TITANIUM ALLOY (5 Al-2.5 Sn) UNDER DRY AND WET CONDITIONS **c26**
Partha Rangaswamy, Hendra Terutung, and Shaik Jeelani *In* Alabama A & M Univ., NASA-HBCU Space Science and Engineering Research Forum Proceedings 1989 p 428-44 (For primary document see N91-28063 19-99)
(Grant NAG8-68)
Avail: NTIS HC/MF A23 CSCL 11F

The principal factors in the performance of aerospace materials are strength-to-weight ratio, fatigue life, fracture toughness, survivability and, of course, reliability. Machining processes and, in particular, grinding under adverse conditions have been found to cause damage to surface integrity and affect the residual stress distribution in the surface and subsurface region. These effects have a direct bearing on the fatigue life. In this investigation the effects of grinding conditions on the fatigue life of Titanium 5 Al-2.5Sn were studied. This alloy is used in ground form in the manufacturing of some critical components in the space shuttle's main engine. It is essential that materials for such applications be properly characterized for use in severe service conditions. Flat sub-size specimens 0.1 inch thick were ground on a surface grinding machine equipped with a variable speed motor at speeds of 2000 to 6000 rpm using SiC wheels of grit sizes 60 and 120. The grinding parameters used in this investigation were chosen from a separate study. The ground specimens were then fatigued at a selected stress and the resulting lives were compared with that of the virgin material. The surfaces of the specimens were examined under a scanning electron microscope, and the roughness and hardness were measured using a standard profilometer and microhardness tester, respectively. The fatigue life of the ground specimens was found to decrease with the increase in speed for both dry and wet conditions. The fatigue life of specimens ground under wet conditions showed a significant increase at the wheel speed of 2000 rpm for both the grit sizes and thereafter decreased with increase profilometry, microhardness measurements and scanning electron microscopic examination. Author

N91-28122*# Howard Univ., Washington, DC. Dept. of Electrical Engineering.
ENGINEERING MANAGEMENT OF LARGE SCALE SYSTEMS **c81**
Serita Sanders, Tepper L. Gill, and Arthur S. Paul *In* Alabama A & M Univ., NASA-HBCU Space Science and Engineering Research Forum Proceedings 1989 p 443-44 (For primary document see N91-28063 19-99)
Avail: NTIS HC/MF A23 CSCL 05A

The organization of high technology and engineering problem solving, has given rise to an emerging concept. Reasoning principles for integrating traditional engineering problem solving with system theory, management sciences, behavioral decision theory, and planning and design approaches can be incorporated into a methodological approach to solving problems with a long range perspective. Long range planning has a great potential to improve productivity by using a systematic and organized approach. Thus, efficiency and cost effectiveness are the driving forces in promoting the organization of engineering problems. Aspects of systems engineering that provide an understanding of management of large scale systems are broadly covered here. Due to the focus and application of research, other significant factors (e.g., human behavior, decision making, etc.) are not emphasized but are considered. Author

N91-28123*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, AL.
AN EVALUATION OF THE INTERFACIAL BOND PROPERTIES BETWEEN CARBON PHENOLIC AND GLASS PHENOLIC COMPOSITES **c24**
Kelvin Jordan, Raymond Clinton, and Shaik Jeelani (Tuskegee Inst., AL.) *In* Alabama A & M Univ., NASA-HBCU Space Science and Engineering Research Forum Proceedings 1989 p 450-47 (For primary document see N91-28063 19-99)
(Grant NGT-50130)
Avail: NTIS HC/MF A23 CSCL 11D

The effects of moisture and surface finish on the mechanical and physical properties of the interfacial bond between the carbon/phenolic (C/P) and glass/phenolic (G/P) composite materials are presented. Four flat panel laminates were fabricated using the C/P and G/P materials. Of the four laminates, one panel was fabricated in which the C/P and G/P materials were cured simultaneously. It was identified as the cocure. The remaining laminates were processed with an initial simultaneous cure of the three C/P billets. Two surface finishes, one on each half, were applied to the top surface. Prior to the application and cure of the G/P material to the machined surface of the three C/P panels, each was subjected to the specific environmental conditioning. Types of conditioning included: (1) nominal fabrication environment, (2) a prescribed drying cycle, and (3) a total immersion in water at 160 F. Physical property tests were performed on specimens

removed from the C/P materials of each laminate for determination of the specific gravity, residual volatiles and and resin content. Comparisons of results with shuttle solid rocket motor (SRM) nozzle material specifications verified that the materials used in fabricating the laminates met acceptance criteria and were representative of SRM nozzle materials. Mechanical property tests were performed at room temperature on specimens removed from the G/P, the C/P and the interface between the two materials for each laminate. The double-notched shear strength test was used to determine the ultimate interlaminar shear strength. Results indicate no appreciable difference in the C/P material of the four laminates with the exception of the cocure laminate, where 20 percent reduction in the strength was observed. The most significant effect and the ultimate strength was significantly reduced in the wet material. No appreciable variation was noted between the surface finishes in the wet laminate. Author

N91-28124*# Tuskegee Inst., AL. School of Engineering and Architecture.

LOW ENERGY SPUTTERING OF COBALT BY CESIUM IONS **c26**

A. Handoo and Pradosh K. Ray *In* Alabama A & M Univ., NASA-HBCU Space Science and Engineering Research Forum Proceedings 1989 p 471-47 (For primary document see N91-28063 19-99)
(Grant NAG8-20)
Avail: NTIS HC/MF A23 CSCL 11F

An experimental facility to investigate low energy (less than 500 eV) sputtering of metal surfaces with ions produced by an ion gun is described. Results are reported on the sputtering yield of cobalt by cesium ions in the 100 to 500 eV energy range at a pressure of 1 times 10(exp -6) Torr. The target was electroplated on a copper substrate. The sputtered atoms were collected on a cobalt foil surrounding the target. Co-57 was used as a tracer to determine the sputtering yield. Author

N91-28125*# Morgan State Univ., Baltimore, MD. Dept. of Physics.

PARAMETERS OF TENSILE STRENGTH, ELONGATION, AND TENACITY OF 70mm IIaO SPECTROSCOPIC FILM **c35**

Ernest C. Hammond, Jr. and Kevin A. Peters *In* Alabama A & M Univ., NASA-HBCU Space Science and Engineering Research Forum Proceedings 1989 p 479-48 (For primary document see N91-28063 19-99)
Avail: NTIS HC/MF A23 CSCL 14E

The 70mm IIaO spectroscopic film was tested to determine its tensile strength, elongation, and breaking strength, using an Instron (strength and compression) 4201 Test Instrument. These data provide information leading to the upper and lower limits of the above parameters for 70mm IIaO spectroscopic film. This film will be developed by a commercial developing machine after the Ultraviolet Telescope Space Shuttle Mission returns to the Earth in the early 1990's; thus, it is necessary to understand these force parameters. Several test strips of approximately 200mm in length were used. The results indicate that when a stress load of 100 kg was applied, the film elongated approximately 1.06mm and the break strength was 19.45 kilograms. Author

N91-28126*# Alabama A & M Univ., Normal. Dept. of Physics.

SURFACE ROUGHNESS OF FLAT AND CURVED OPTICAL SURFACES **c74**

M. C. George, Bandi Jagannadha Reddy, H. Jagannath, M. Perera, and P. Venkateswarlu *In* Alabama A & M Univ., NASA-HBCU Space Science and Engineering Research Forum Proceedings 1989 p 482-48 (For primary document see N91-28063 19-99)
(Grant NAG8-29)
Avail: NTIS HC/MF A23 CSCL 20F

Surface roughness measurement has several applications. Even a few A roughness will cause scattered light in optical systems. Smooth surfaces are required in a wide variety of instruments. For example, the outputs of the high power lasers are limited by the surface roughness of mirrors and windows. Similarly, the information storage capacity of magnetic media is limited by the roughness of the surface. Roughness reduces the resolving power of optics and distorts images. The performance of certain thin film components in electronic industries is affected by the roughness on the film surface. X-ray astronomical telescopes require smooth curved surfaces. To improve the surface quality, super sensitive detection methods are required. Wide ranging measurement techniques are developed based on interferometry, electron microscopy, C-rays, ellipsometry, light scattering, and using mechanical stylus, etc. Though there are several techniques available for measurement and evaluation of the surfaces, no single technique is fully adequate. Also, the technique used should be nondestructive and highly sensitive. So, an optical heterodyne profilometer was fabricated. Its current sensitivity is much better than 10A rms. It is a noncontact and nondestructive technique. The instrument can be operated even by unskilled personnel for routine measurements. Author

N91-28127*# Howard Univ., Washington, DC. Dept. of Systems and Computer Science.

SUGGESTED CRITERIA FOR EVALUATING SYSTEMS ENGINEERING METHODOLOGIES **c31**

Audrey Gates, Arthur S. Paul, and Tepper L. Gill *In* Alabama A & M Univ., NASA-HBCU Space Science and Engineering Research Forum Proceedings 1989 p 489-49 (For primary document see N91-28063 19-99)
Avail: NTIS HC/MF A23 CSCL 13B

Systems engineering is the application of mathematical and scientific principles to practical ends in the life-cycle of a system. A methodology for systems engineering is a carefully developed, relatively complex procedure or process for applying these mathematical and scientific principles. There are many systems engineering methodologies (or possibly many versions of a few methodologies) currently in use in government and industry. These methodologies are usually designed to meet the needs of a particular organization. It has been observed, however, that many technical and non-technical problems arise when inadequate systems engineering methodologies are applied by organizations to their systems development projects. Various criteria for evaluating systems engineering methodologies are discussed. Such criteria are developed to assist methodology-users in identifying and selecting methodologies that best fit the needs of the organization. Author

N91-28128# Naval Postgraduate School, Monterey, CA.

A SUMMARY OF THE NAVAL POSTGRADUATE SCHOOL RESEARCH PROGRAM AND RECENT PUBLICATIONS, OCTOBER 1988 TO SEPTEMBER 1989

30 Aug. 1990 373 p
(AD-A236052; NPS-012-90-002) Avail: NTIS HC/MF A16 CSCL 05/2

This report contains 330 summaries of research projects which were carried out under funding of the Naval Postgraduate School Research Program. A list of recent publications are also included which consist of conference presentations, contributions to books, published papers, and technical reports. The research was conducted under the areas of: computer science, mathematics, administrative sciences, operations research, national security affairs, physics, electrical and computer engineering, meteorology, aeronautics and astronautics, oceanography, and mechanical engineering, antisubmarine warfare, space systems, electronic warfare, and in command control communications. GRA

N91-28129# Office of Naval Research European Office, FPO New York, NY.

EUROPEAN SCIENCE NOTES INFORMATION BULLETIN REPORTS ON CURRENT EUROPEAN/MIDDLE EASTERN SCIENCE

Connie R. Orendorf Apr. 1991 87 p
(AD-A236072; ONREUR-ESNIB-91-03) Avail: NTIS HC/MF A05 CSCL 05/2

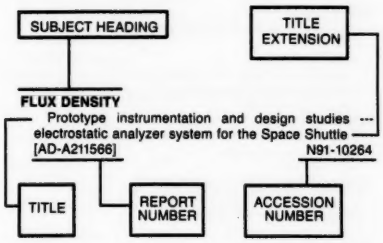
ESNIB 91-03 is a compilation of reports on recent developments in European science of specific interest to the U.S. research and development community. Partial contents: Natural gas clathrates -

Arctic and Nordic Sea potential; Air-electricity laboratory - Tartu, Estonia; Closing a gap between parallel computing and physical science; Coling-90 Conference; Critical research directions in metal-matrix composites; Powder-free processing for advanced ceramics; Marine Technology Directorate research Programs; Energetic materials - New synthesis routes, ignition, propagation, and stability of detonation; Super conductivity - Report on the Localization 1990 Conference; and Workshop on computational and biological models of visual processing. GRA

N91-28130# Air Force Academy, CO. Library.
THE UNITED STATES AIR FORCE ACADEMY: A BIBLIOGRAPHY, 1983-1989
Elwood L. White, comp. Dec. 1990 66 p
(AD-A236561) Avail: NTIS HC/MF A04 CSCL 05/6

This compilation of resources on the United States Air Force Academy includes materials published between 1 January 1983 and 31 December 1989. It updates the third supplement, which was published in 1984. Although recent Academy Assemblies and Harmon Memorial Lectures are a part of this compilation, a number of materials published at the Academy are not included. A few items are cited which pre-date the years covered by this supplement. The basic arrangement is by subject areas, and within each subject area, the listing is subdivided as follows: Air Force regulations; books; newspaper and periodical articles; government documents; and other sources. GRA

Typical Subject Index Listing



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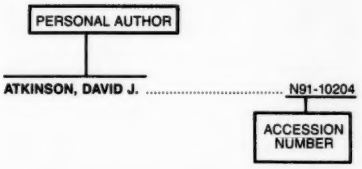

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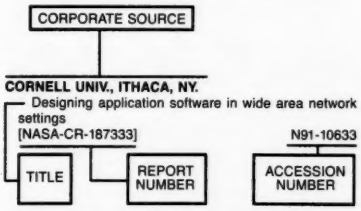

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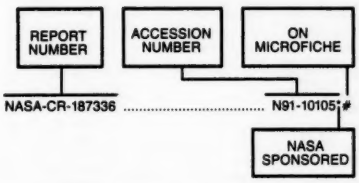

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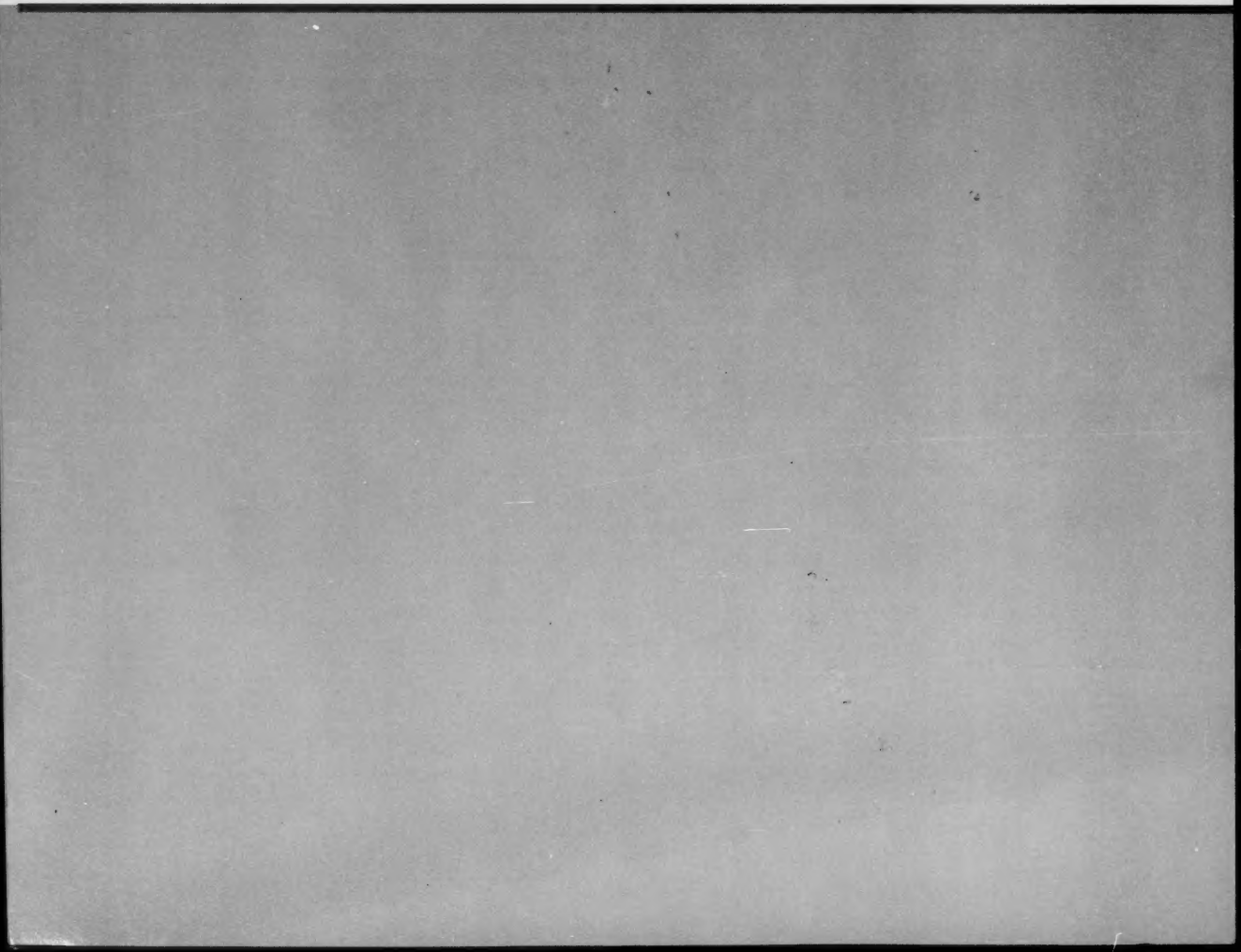
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